

SALMON SPAWNING GROUND SURVEYS IN THE BRISTOL BAY AREA, ALASKA, 1992

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ABSTRACT

Aerial surveys were conducted during 1992 in the Naknek-Kvichak, Egegik, Ugashik, Nushagak, and Togiak Districts of Bristol Bay, Alaska, to assess salmon escapement abundance and distribution. Alagnak River index counts totaled 226,643 sockeye, 3,042 chinook, and 114,000 chum salmon. Total sockeye salmon escapements estimated from tower counts for the Kvichak and Naknek Rivers were 4,725,864 and 1,606,650 respectively. Naknek River drainage index counts for chinook salmon yielded a total of 2,691 spawners. Egegik District index counts totaled 1,508 chinook, and 9,500 chum salmon. The total sockeye salmon escapement estimated from tower counts for the Egegik River was 1,945,332 fish, the fourth largest tower count on record for this system. Ugashik District index counts totaled 21,235 sockeye (Dog Salmon and King Salmon Rivers), 4,673 chinook, and 43,185 chum salmon. Total sockeye and partial pink salmon escapements estimated from tower counts for the Ugashik River were 2,173,692 and 1,728 respectively. Spawning escapements of salmon in the Nushagak-Mulchatna River system were estimated using sonar at Portage Creek and totaled 695,108 sockeye, 82,848 chinook, and 302,678 chum salmon. Sockeye escapements were estimated from tower counts in the Wood and Igushik Rivers, and totaled 1,286,250 and 304,920. The sockeye escapement in the Togiak Lake system estimated from tower counts totaled 199,056, while aerial surveys of Togiak River below the tower yielded an additional inriver escapement estimate of 16,460. The escapement estimate for sockeye salmon in Togiak River and Lake combined totaled 215,516. Sockeye salmon escapement in Kulukak Bay drainages, estimated from aerial surveys, totaled 26,440. Chinook and chum salmon escapements for the Togiak and Kulukak Rivers combined were estimated at 8,626 and 82,500 respectively. The Togiak River pink salmon escapement estimate totaled 235,000 fish, the second largest estimate on record, trailing only the estimate in 1984. Coho escapements in both the Togiak and Kulukak Rivers, 80,100 and 37,920 respectively, were the largest recorded since the inception of coho salmon surveys in 1980.

KEY WORDS: Sockeye salmon, chinook salmon, chum salmon, pink salmon, coho salmon, Bristol Bay, spawning escapement enumeration, population estimation, aerial surveys, ground surveys

INTRODUCTION

Aerial surveys of salmon spawning streams have been conducted in Bristol Bay, Alaska, (Figure 1) for many years to provide biologists with information regarding the abundance and distribution of sockeye salmon (*Oncorhynchus nerka*), chinook salmon (*O. tshawytscha*), chum salmon (*O. keta*), pink salmon (*O. gorbuscha*), and coho salmon (*O. kisutch*) escapements. This information supplements data gathered at counting towers on mainstem rivers, supplies data for time periods and species not covered by counting tower operations, and provides data for rivers where counting towers were not used. The data collected is used to: 1) evaluate escapement goals and escapement-return relationships; 2) forecast future returns; and 3) identify and solve management problems relating to attainment of escapement goals. This report summarizes the 1992 salmon spawning ground surveys conducted in the Bristol Bay area.

Naknek/Kvichak District

The Naknek-Kvichak District is comprised of three major drainages (Figure 2): 1) Kvichak River, draining Iliamna Lake and its tributaries, 2) the Alagnak (Branch) River draining Kukaklek and Nonvianuk Lakes, and 3) the Naknek River draining Naknek Lake and its tributaries. All these systems empty into Kvichak Bay.

Sockeye salmon escapements in the Kvichak River have been estimated each year since 1955 using counting towers on the mainstem river just downstream of the Iliamna Lake outlet. Sockeye escapement counts from the Naknek River were obtained from 1950-1957 using a weir on the mainstem river just upstream of tidal influence. From 1958 to the present they have been estimated using counting towers in the Naknek River "Rapids" downstream of the outlet of Naknek Lake. Alagnak River sockeye escapements were estimated from 1957-1976 using a counting tower near the upper extent of tidal influence on the lower river. Since 1977 all Alagnak sockeye escapement estimates have index counts based on aerial surveys. All estimates of other salmon species from Naknek-Kvichak District drainages have been obtained using aerial surveys.

Egegik District

The Egegik River system contains two major river drainages: 1) Egegik River proper, draining Becharof Lake and nearby coastal lowlands, and 2) King Salmon River, draining runoff from the Kejulik Mountains and southern portions of Katmai National Park (Figure 3). These two rivers empty into the head of Egegik Bay near Egegik village.

Sockeye salmon escapement counts in the Egegik River were obtained from 1952-1956 using a weir at the base of the Egegik River "Rapids". From 1957 to the present sockeye escapement estimates

were obtained using counting towers situated between the outlet of Becharof Lake and Egegik Lagoon. Escapement estimates for other salmon species have been obtained through use of aerial surveys.

Ugashik District

The Ugashik River system is comprised of four major drainages: (1) Ugashik River proper, draining Ugashik Lakes and nearby coastal lowlands, (2) Dog Salmon River, fed by glacial melt and runoff from peaks in the Aleutian Range, (3) King Salmon River, draining Mother Goose Lake and three major runoff tributaries, and (4) Dago Creek, draining a large area of coastal lowlands (Figure 4). All these drainages empty into the intertidal reaches of Ugashik River and Ugashik Bay.

Sockeye salmon escapement counts in the Ugashik River were obtained from 1949-1956 using a weir just downstream of the outlet of Lower Ugashik Lake. From 1957 to the present sockeye escapement estimates were obtained using counting towers situated between the outlet of Lower Ugashik Lake and Ugashik Lagoon. Escapement estimates for other salmon species have been obtained through use of aerial surveys.

Nushagak District

Nushagak District is comprised of four major drainages: 1) Wood River, draining Grant, Kulik, Beverley, Nerka, and Aleknagik Lakes, 2) Nushagak River, draining the Tikchik Lakes and the Nuyakuk, upper Nushagak, and Mulchatna Rivers, 3) Igushik River, draining Ualik and Amanka Lakes, and 4) Snake River, draining Lake Nunavaugluk (Figures 5 through 8). All these systems empty into Nushagak Bay.

Sockeye escapement in the Wood River Lake system is estimated from counting towers at the outlet of Lake Aleknagik. Spawner distribution within the Wood River Lake system is assessed each year from aerial surveys, conducted by the department, and ground surveys, conducted on the major creeks and some rivers of the system by the University of Washington, Fisheries Research Institute. On streams and rivers where both aerial and ground counts are conducted, the ground count is generally considered more accurate.

Sockeye salmon distribution in the Wood River Lake system is an important element in establishing escapement goals and measuring management success for this system. The few interconnecting rivers between the large lakes in the system are primarily used by the 3-ocean sockeye for spawning, while the lake beaches and tributary streams are more heavily used by 2-ocean sockeye. Having advance knowledge of the age composition of the incoming sockeye run gives managers the ability to use a variable escapement goal policy to attempt to minimize overcrowding of spawners in the interconnecting

rivers while taking advantage of the large beach spawning areas and numerous tributary streams. Surveys of the actual spawning distribution within the creeks, rivers, and beaches of the system provide a measure of management success in obtaining the desired spawning distribution.

A hydroacoustic project, located on the Nushagak River below Portage Creek and approximately 32 km (20 miles) upstream from the river mouth, is used to estimate escapement of all salmon species that spawn in the Nushagak drainage. Although reliable estimates of the spawning escapements for all species of salmon have been produced by the sonar project for years, aerial surveys on the Nushagak-Mulchatna system had been continued until recently to provide a comparison with sonar estimates and to document spawner distribution of all salmon species, with the exception of coho. Chum salmon surveys were discontinued in the Nushagak District in 1980, and beginning in 1991, all surveys of the Nushagak-Mulchatna system were discontinued due to lack of funding.

Distribution of spawning sockeye in the Tikchik Lake system was documented from aerial surveys as recently as 1991. Typically, the Tikchik Lakes system receives the majority of sockeye salmon that enter the Nushagak River. However, the 1990 and 1991 Nushagak escapements were distributed more heavily in the Nushagak-Mulchatna system, with fewer fish entering the Tikchik Lakes system. The most recent spawner distribution information for salmon in the Nushagak-Mulchatna and Tikchik Lake drainages is presented in Russell, Regnart, and Brookover (1992).

Sockeye escapement is measured in the Igushik Lakes system at a counting tower located at the outlet of Amanka Lake. Spawner distribution is not documented annually, but surveys have been conducted on the Igushik system for sockeye and other species in the past, and as recently as 1991 (Russell, Regnart, and Brookover, 1992). Spawning escapement and distribution of sockeye salmon in the Snake Lake system is estimated each year exclusively by aerial surveys, however, lack of funding prevented Snake Lake surveys in 1992.

Togiak District

The Togiak District is comprised of two major river drainages: 1) Togiak River, draining Togiak, Gechiak, Pungokebuk, and Ongivinuck Lakes as well as the Naylorun and Kemuk Rivers (Figure 9), and 2) Kulukak River, draining Kulukak Lake (Figure 10). Various smaller systems within the District include Tithe Creek Ponds and the Quigmy, Matogak, Osviak, Slug, Negukthlik, and Ungalikthluk Rivers. The Kulukak River and Tithe Creek Ponds flow into Kulukak Bay, located in the eastern portion of the District, the Togiak and Quigmy Rivers flow into Togiak Bay, located in the middle of the District, and the Matogak, Osviak, and Slug Rivers flow into

Hagemeister Straits and coastal waters in the western portion of the District (Figure 1).

Sockeye escapement is estimated for the Togiak Lake system from a counting tower operated at the outlet of Togiak Lake. Abundance and distribution of spawning populations of sockeye salmon in the Togiak River and tributaries below the counting tower, and all other systems in the Togiak District, are estimated solely by aerial surveys. Abundance and distribution of chinook, chum, pink, and coho salmon spawning in Togiak District watersheds are estimated entirely from aerial surveys.

METHODS

Unless otherwise noted survey flights were conducted from small fixed-wing, high-wing, wheeled aircraft (Super Cub, Cessna 180, or Cessna 185) chartered from local air charter companies and flown by experienced survey pilots. The only exception to this in 1992 occurred in the Egegik and Ugashik drainages where surveys were conducted for the first time from a Robinson R-22 two-seater helicopter. Several surveys in the Togiak National Wildlife Refuge (TNWR) were flown by refuge staff pilots in U.S. Fish and Wildlife Service (USFWS) aircraft. Fish were counted by Department of Fish and Game or USFWS biologists familiar with the streams and target species. Counts from fixed wing aircraft were made from low altitudes (200 to 400 feet) at air speeds of 50 to 80 mph. Slower air speeds were used during helicopter based surveys. Polaroid sunglasses and aircraft positioning were used to minimize effects of glare off the water. Surveys were scheduled to coincide as closely as possible to the historic peak of spawning for the target species, taking into account weather, water conditions, and aircraft availability. Peak of spawning was defined as that point when the greatest number of spawning fish are occupying redds. Counts were registered on hand tally counters or tape recorded and then entered on survey data forms.

It is recognized that aerial spawning ground surveys account for only a portion of the known spawning populations (Evzerof, 1975; Nielson and Green, 1981; Rogers, 1984). At the time of each survey, some of the fish have yet to reach the spawning grounds, some have spawned and died, some are schooled, and others are misidentified or not seen. Methods used to interpret aerial survey index counts are described below for each commercial fishing district.

Naknek/Kvichak District

Aerial surveys were flown during late summer and fall to assess escapements of sockeye, chinook, and chum salmon in portions of the Naknek-Kvichak District. Salmon counts for these drainages are indices of the total number of each species present in the spawning area at the time of the survey. Two surveys were flown (August 10 & 21) to provide estimates of Alagnak River drainage sockeye, chinook, and chum escapements. Additionally, all major chinook spawning areas in the Naknek River drainage were surveyed during August to derive the chinook escapement index. These index counts were not expanded to provide instantaneous population estimates as was done in some previous years (based on subjective criteria available to the surveyors such as...expansions for unsurveyed portions of drainages, expansions compensating for areas of poor visibility, etc). Tower counts were used to obtain total sockeye salmon escapement estimates in the Kvichak and Naknek Rivers. A late summer survey of sockeye salmon spawning distribution in the Kvichak River system was accomplished and the results will be documented in a another report. All aerial survey counts were accomplished by ADF&G, Commercial Fisheries Division staff.

Egegik District

No system-wide aerial surveys were flown for sockeye salmon in 1992. Aerial surveys were flown on August 6 of all known chinook and chum salmon spawning areas in both the Egegik and King Salmon Rivers, and counts of both species were obtained concurrently. Due to budget constraints no aerial surveys were flown to estimate pink or coho salmon escapements in Egegik District drainages. Survey counts in the Egegik District reflect only the actual numbers of salmon sighted and should be considered an index of abundance only.

Ugashik District

Salmon counts in the Ugashik District reflect only the actual numbers of salmon sighted on the spawning grounds during the August 11 aerial surveys and should be considered only as an index of total abundance.

Nushagak District

Survey methods in the Nushagak District, and subsequent analysis of the data was consistent with methods described by Nelson (1979), Bucher (1981), and Russell, Bill and Bucher (1990).

Peak aerial counts for sockeye salmon in the Wood, Igushik, Snake, and Tikchik Lakes systems have generally accounted for 50% (range 29%-65%) of the actual escapements estimated at towers or weirs on those systems (Nelson, 1967 and 1979). In the Igushik, Snake, and Tikchik systems, peak aerial counts of sockeye salmon are typically expanded by a factor of 2.0 to estimate total escapement. However,

other factors may be applied at the discretion of the surveyor depending on weather, visibility, and survey timing. In the Wood River system the sockeye escapement for each spawning stream, beach, or river has historically been estimated using the proportion of fish observed at any given location relative to the total tower count, with different expansion factors assigned to each type of spawning habitat. For a more detailed description of the analysis of Wood River survey counts, see Nelson (1973).

Togiak District

Survey methods and data analysis used in Togiak District are also similar to methods described by Nelson (1979), Bucher (1981), and Russell, Bill, and Bucher (1990). Aerial surveys in 1992 were conducted at the peak of spawning for each species, similar to the methods used by Nelson and Bucher in the late 1970's and early 1980's.

Aerial survey counts for sockeye salmon in the Togiak Lake system above the counting tower have generally accounted for 47% (range=40%-50%) of the escapements estimated at the tower (Nelson, 1967). Therefore, aerial counts of sockeye salmon in systems without counting towers (i.e. Kulukak River and the mainstem and tributaries of the Togiak River below the tower) are multiplied by 2.0 to estimate total escapement. Since 1980, aerial counts of chinook salmon in the Togiak District have typically been multiplied by 2.5 to estimate escapement. Since 1968 chum escapements have generally been estimated by multiplying aerial counts by 2.0, as justified in Nelson (1968), and since 1978, pink escapements have also been estimated by applying a factor of 2.0 to the aerial counts. An expansion factor of 3.0 was deemed most appropriate for coho salmon counts based on a streamlife study in the Gechiak River (Minard, 1986), and has been used for that species in all areas of the Togiak District since coho surveys were initiated in 1980. Expansion factors may be subjectively adjusted based on weather conditions, visibility, and survey timing with respect to the peak spawning activity.

RESULTS AND DISCUSSION

Naknek-Kvichak District

Aerial surveys of the Alagnak River and its tributaries were conducted on August 10 and 21. The sockeye escapement index count totaled 226,643 for this system (Table 1). This count was slightly above the mean index of 193,000 obtained from 1977-1991, the span of years during which aerial surveys have been used to estimate the Alagnak sockeye escapement index. The 1992 index was approximately 22% greater than the escapement point goal of 185,000 sockeye. The actual sockeye escapement to this system was probably even greater since the index count was not expanded to represent an estimate of

total escapement. Historic sockeye escapement count data for the Alagnak River drainage is presented in Appendix Table 1. Total sockeye salmon escapements estimated from 1992 tower counts for the Kvichak and Naknek Rivers were 4,725,864 and 1,606,650 respectively (Appendix Table 1).

Aerial surveys were flown in the Naknek River drainage during the interval from August 1 - August 27 to estimate chinook escapement indices in each of the four main spawning component areas (mainstem Naknek River, Big Creek, King Salmon Creek, and Paul's Creek). Cumulatively, an index of 2,691 chinook was observed for the entire Naknek drainage. The largest components of this index were counts of 895 chinook in Big Creek on August 18, and 1,550 chinook in the mainstem Naknek River on August 27 (Table 2). Peak counts and historic survey data recorded for these four areas are presented in Appendix Tables 2-6. Over the period from 1970-1992 there have been 13 years in which chinook escapement indices have been obtained from all component areas within the Naknek River drainage (Appendix Table 2). The chinook escapement index for these 13 years has ranged from a low of 2,691 in 1992 to a high of 11,730 in 1988. Comparatively, the 1992 index was the smallest on record over this span of years, just 55% of the mean chinook escapement index (4,859) in the drainage from 1970-1992.

The Alagnak River drainage chinook escapement was surveyed on August 10 and again on August 21, yielding an index of 3,042 fish (Table 2). Chinook salmon index counts for the Alagnak River drainage from 1970-1992 have ranged from a low of 824 in 1973 to a high of 7,593 in 1976 with an average of 3,428 fish, so the 1992 count was slightly below average (Appendix Table 9). An aerial estimate of chinook escapement in the Kvichak River was conducted on August 13 and yielded an index of 264 fish (Table 2). Comparative counts over the years from 1970-1992 are presented in Appendix Table 9. The 1992 index count was very near average for the Kvichak.

The Naknek-Kvichak District chinook escapement index (sum of the above three drainages) totaled 5,997 fish (Appendix Table 9). This was the lowest total since 1985, and it was well below the mean district escapement index of 8,199.

Chum salmon were counted only during the August 10 Alagnak River aerial surveys (Table 2). The Alagnak River has been the principal chum salmon producing drainage in the Naknek-Kvichak District. A total of 114,000 spawning chums were observed during the 1992 survey. Historic chum salmon escapement index counts for the Alagnak River from 1961-1992 are presented in Appendix Table 10.

No surveys were flown directly to index pink salmon escapements in Naknek-Kvichak District drainages during 1992. However, 15,000 pinks were noted in the Alagnak River on August 10 during the sockeye/chinook surveys. Historic pink salmon escapement index

counts for the Alagnak River, Kvichak River, and Naknek River from 1966-1992 are presented in Appendix Tables 11-13.

Escapement surveys targeting coho salmon were not flown in Naknek-Kvichak District drainages during 1992 due to budget constraints.

Egegik District

The 1992 Egegik River sockeye escapement counted past the counting towers totaled 1,945,332 fish, the fourth largest count on record for this system. Although no system-wide aerial surveys were flown, an additional 300 sockeye salmon were counted in King Salmon River tributaries. No surveys of the distribution of the Egegik River sockeye escapement were flown due to budget constraints.

Aerial surveys of all known chinook spawning areas were conducted August 6 and yielded a total index count of 1,508 chinook salmon (Table 3). This was the second highest escapement index recorded over the 12 years (1981-1992) during which surveys have been conducted (Appendix Table 14). It was well above the 1981-1991 mean index count of 1,210 chinook salmon. The commercial harvest of chinook salmon in the Egegik District was small with only 564 chinook salmon landed, just 19% of the recent 20-year (1972-1991) mean harvest of 2,915 chinook. This was largely due to a closure of the commercial fishery from June 1-22 to facilitate passage of chinook salmon through the district and into the escapement. Overall it was apparent the 1992 Egegik District chinook salmon run was well below average.

A total of 9,500 chum salmon were counted during surveys of all known spawning areas on August 6 (Table 4). Comparison of 1992 indices with those from prior years indicated the chum salmon escapement abundance was well below the 1982-1991 average of 15,215. Historic chum salmon index count data is presented in Appendix Table 15. The 1992 commercial harvest of 113,977 chum salmon in Egegik District was the third smallest in the last 10 years thus its evident the run was a little below recent average strength. Escapement indices of less than 10,000 fish have been registered in the district each of the last four years and this is cause for concern for district managers, but daily monitoring of the chum and chinook escapements into the murky waters of King Salmon River cannot be accomplished without either a weir or hydroacoustic equipment. Since the peak of the chum salmon run closely overlaps the peak of the sockeye salmon run, the much less abundant chum salmon resource has been exploited at a higher rate by the commercial fishery in order to harvest the abundant sockeye salmon runs in recent years.

No pink salmon or coho salmon surveys were conducted in the Egegik drainage in 1992 due to budget constraints. Historic escapement index data for these species is presented in Appendix Tables 16-17. The commercial pink salmon harvest in the Egegik District was

minimal totaling less than 1,000 fish, and the coho salmon harvest totaled 47,266 fish, well above the 1972-1991 average of 26,864, suggesting a run of at least average strength.

Ugashik District

The 1992 sockeye escapement count past Ugashik River counting tower totaled 2,173,692 fish, the fourth largest escapement on record and more than three times the desired point goal of 700,000. No system-wide aerial surveys documenting the distribution of this large escapement were flown due to budget constraints, but an additional 7,810 and 13,425 sockeye salmon were counted in the Dog Salmon and King Salmon River drainages, respectively, on August 11 (Table 5).

Chinook salmon escapement surveys of Dog Salmon, King Salmon, and Ugashik River drainages were flown August 11, yielding index counts of 821, 3,680, and 172 chinook salmon, respectively (Table 6), and totaling 4,701 for the entire system. The 1992 total escapement index of 4,701 was slightly lower than the 1980-1991 mean escapement index of 5,118 chinook salmon, but was larger than indices obtained the last three years. Historic chinook salmon escapement index data is presented in Appendix Table 18. The Ugashik District chinook salmon run appears to have been below average as the commercial harvest was also weaker than usual. Only 2,246 chinook salmon were harvested commercially in 1992, well below the 1972-1991 average of 3,540.

Chum salmon were also counted during the aerial surveys of the Dog Salmon, King Salmon, and Ugashik River drainages on August 11, yielding a total escapement index count of 43,185 chum salmon (Table 7). Surveys were thought to be near the peak of spawning abundance. The 1992 escapement index was the fourth largest obtained since 1980 (Appendix Table 19), slightly above the 1980-1991 mean index of 40,167. The commercial harvest of chum salmon in the Ugashik District totaled 56,949 fish, slightly above the 1972-1991 mean commercial harvest of 55,056 fish.

The Ugashik District pink salmon run has historically been very small. Such was the case again in 1992. A total of 1,728 pinks were counted past Ugashik River tower before the counting program was terminated July 29), and only 162 were reported caught commercially. No aerial surveys targeting pink salmon spawning were accomplished in 1992. Historic pink salmon escapement index data is presented in Appendix Table 20.

No aerial surveys targeting coho salmon were made in the Ugashik District drainages in 1992 due to budget constraints. Historic coho salmon escapement index data is presented in Appendix Table 21. The Ugashik District commercial fishery harvested 35,404 cohos, well above the 1972-1991 average harvest of 23,973. Cohos were reported

spawning well into December in Painter Creek, a tributary of King Salmon River.

Nushagak District

In 1992, budget shortfalls would have prevented all aerial surveys within the Nushagak District, but funding provided by the University of Washington, Fisheries Research Institute (FRI), enabled aerial survey coverage of the Wood River Lake system sockeye spawning population. Surveys were not conducted on the Nushagak-Mulchatna, Tikchik Lake, or Snake Lake systems.

Peak aerial estimates of sockeye spawners and total population estimates in the Wood River lakes system are presented in Table 8. High water affected survey timing and visibility on the lake beaches and the Agulowak and Agulukpak Rivers. Aerial counts for the Agulowak and Agulukpak Rivers were prevented at the peak of spawning due to high water and poor conditions. Several surveys were attempted for both rivers but accurate counts could not be obtained until after spawning activity peaked, so counts may be conservative for that reason. Beach surveys were slightly past the peak of spawning, based on the presence of several hundred carcasses observed on some beaches, most notably in Lake Aleknagik and Lake Nerka. Aerial counts for the lake beaches, however, were not adversely impacted.

The 1992 Wood River tower count of 1,286,250 sockeye was greater than the escapement point goal of 1,000,000 fish, and greater than the upper end of the desired escapement goal range of 1,200,000. The current (and historic) distribution of spawners by type of spawning area is presented in Appendix Table 22. Although the estimate of the river spawning component may be conservative, the river spawning component of the escapement was relatively low for the second consecutive year, and the majority of spawners were observed on the lake beaches.

The 1992 sockeye escapement in the Nushagak River drainage, estimated at the Portage Creek sonar, totaled 695,108 fish, above the desired escapement goal of 550,000 (Miller, *in press*). In both 1990 and 1991, a large component (44% or greater) of the Nushagak sockeye escapement was comprised of fish with the freshwater age of 0, fish that migrated to sea in their first year of life. Also in both years, sockeye spawning activity appeared to be concentrated in the upper Nushagak and Mulchatna Rivers, rather than in the Tikchik Lake system, which usually receives the bulk of Nushagak River sockeye spawners. A large portion of the 1992 escapement was again comprised of Age 0.-freshwater fish, which may indicate that a large component of Nushagak drainage escapement was once again destined for the Nushagak-Mulchatna system. However, since aerial surveys of the Tikchik Lake and Nushagak-Mulchatna systems were precluded in 1992, the actual spawner distribution is unknown.

No surveys were flown in 1992 to estimate sockeye escapement numbers in the Lake Nunavugaluk. Historic survey count data for this drainage is presented in Appendix Table 23.

The estimated 1992 escapement of chinook salmon in the Nushagak drainage counted past the Portage Creek sonar totaled 82,848, 10% above the inriver goal of 75,000. A summary of chinook escapement estimates and commercial harvests for the Nushagak District from 1973-1992 is presented in Appendix Table 24. The 1992 inriver passage was 13% and 9% below the 1973-1992 and 1983-1992 averages.

The chum salmon escapement in the Nushagak River was estimated at 302,678 fish in 1992. This estimate was above average for the period 1983-1992, but comprised only 87% of the escapement goal of 350,000 fish. A summary of chum salmon escapement estimates and commercial harvests for the Nushagak District from 1973-1992 is given in Appendix Table 25.

The Nushagak River sonar project was terminated prematurely (July 23) due to budget restrictions, which precluded any total escapement estimates for pink and coho salmon. FRI donated funding for surveys of the pink salmon escapement in the Nushagak River system, but poor weather and water conditions prevented the surveys. Historic pink salmon escapements are presented in Appendix Table 26.

Togiak District

Budget constraints would have precluded the Department from conducting aerial surveys in the Togiak District for the second consecutive year, but the U.S. Fish and Wildlife Service, Togiak National Wildlife Refuge (TNWR), again donated an aircraft, pilot, and funding for charter aircraft. Aerial surveys of spawning sockeye, chinook, chum, pink, and coho salmon were conducted. Survey coverage was divided between a USFWS observer and a Department observer. Several systems were flown with both surveyors aboard the same aircraft, and several surveys were duplicated with each observer in a separate aircraft, to obtain comparable counts.

Peak aerial counts and total (expanded) 1992 escapement estimates for sockeye salmon in the major sockeye-producing rivers of the Togiak District are shown in Table 9. Weather and water conditions were good at the time of the sockeye surveys, and an expansion factor of 2.0 was used to estimate spawning escapement in most areas. A factor of 3.0 was applied to the Kulukak River sockeye count to account for late survey timing, and 2.5 was used for Gechiak River sockeye, to account for early survey timing.

Sockeye escapement for the mainstem Togiak River and its tributaries was estimated at 16,460 fish, well below the 1983-1992 average (Appendix Table 27), even though escapement into the Togiak

Lake system was above average. Escapement past the Togiak River counting tower was estimated at 199,056 fish, therefore the combined sockeye escapement in Togiak River totaled 215,516. The spawning population in the Kulukak River Section, including Tithe Creek Ponds, totaled 26,440 sockeye, 79% of the 1983-1992 average (Appendix Table 27), and 76% of the escapement goal (35,000 fish) for those systems. A comparison of peak aerial counts within the Togiak River drainage and throughout Togiak District from 1973-1992 is presented in Appendix Tables 28 and 29. Areas where peak sockeye counts were considerably less than the 1973-1992 average include the mainstem portion of the Togiak River and Tithe Creek Ponds, while counts for the Osviak and Negukthlik Rivers were above average. Sockeye escapements for the entire district totaled 266,956 fish.

Aerial counts of sockeye salmon in the Matogak, Osviak, Quigmy, Negukthlik, and Ungalikthluk Rivers were obtained incidentally during surveys of chum and chinook salmon escapements and later, through additional survey efforts by the TNWR. Escapement estimates for most of these rivers were based on the earlier surveys in keeping with the methodology described in Nelson (1979). The exceptions were the Osviak and Negukthlik River estimates which were based on the later TNWR surveys; this resulted in higher escapement estimates than those that would have resulted based on the earlier surveys of these systems.

Aerial live counts and expanded escapement estimates of Togiak District chinook salmon are presented in Table 10. The 1992 chinook escapement estimate for the Togiak River fell short of the escapement goal for the seventh consecutive year in spite of an extended closure during the traditional peak of the commercial chinook fishery. The escapement estimate of 7,410 chinook in the Togiak River comprised only 74% of the escapement goal of 10,000 fish. The estimated chinook escapement in the Kulukak River (1,213) exceeded the goal of 1,000 for that river. The district escapement totaled 10,410 chinook, comparable to the relatively low escapement levels experienced since 1986, but well below the 1973-1992 average of 16,000 (Appendix Table 24). Summaries of aerial live counts of chinook salmon for the Togiak River drainage and the entire Togiak District are presented in Appendix Tables 30 and 31. Below average (1973-1992) numbers of chinook spawners were observed in most of the Togiak River mainstem as well as in most of the tributaries to the Togiak River. In fact, chinook counts in all rivers surveyed were below 1973-1992 averages. Survey conditions and timing were good in all areas, and the standard factor of 2.5 was applied to all aerial counts of chinook. Surveys of the Togiak River system were flown later than the preferred time described in Nelson (1979), and instead of being flown between the peak of spawning for both chum and chinook, were flown at the peak of spawning for chinook, and after the peak of spawning had occurred for chum salmon. Timing for the Negukthlik system is generally assumed to coincide with the other systems within Togiak District,

as described in Nelson (1979). As in 1991, a higher count occurred later (August 7) with fish well distributed, compared to a survey on the more typical date of July 28, when many fish were observed still in large schools. Timing of spawning activity in all other areas was more typical for chinook salmon, and peaked during the first week of August.

The chum salmon escapement for the entire Togiak District was estimated at 120,000 (Table 11). Counts were obtained from the same surveys used to count chinook; survey timing was good in the smaller streams, but past the peak of spawning in the Togiak and Kulukak Rivers, as evidenced by large numbers of carcasses. Togiak and Kulukak River escapement estimates were based on the results of management surveys conducted well before the peak of spawning, when fish were still migrating. A factor of 3.0 was applied to the Togiak, Kulukak, and Slug Rivers to compensate for survey timing. The district chum escapement was less than 50% of the 1973-1992 average, and 55% of the 1983-1992 average (Appendix Table 25). The escapement estimate for the Togiak River (68,100) is less than 50% of the goal of 200,000, however, that estimate may be conservative. Appendix Tables 32 and 33 compare the aerial live counts of chum salmon in the Togiak River drainage, and in the Togiak District, by river system and year for 1973-1992. Peak counts of chum salmon in 1992 were below average (1973-1992) in all major river systems surveyed in the Togiak District.

Coho escapements in both the Togiak and Kulukak Rivers were the highest documented since the inception of surveys for spawning coho salmon in 1980. The Togiak River escapement of 80,100 fish was well above the goal of 50,000 fish for that river, and similarly, the Kulukak River escapement (37,920) far exceeded its escapement point goal of 15,000 fish goal (Table 12). A historical comparison of aerial counts can be found in Appendix Tables 34 and 35. Good weather and water conditions prevailed in late September and early October, enabling excellent counting conditions. Water levels were very low during the coho surveys, and many small lakes and sloughs were covered with newly formed ice. The ice did not affect visibility, and a few coho salmon were observed milling beneath the ice layer. Spawning distribution in the Togiak River appeared to be heavier than usual in the Gechiak River and the upper portions of the mainstem Togiak River in 1992, and possibly lighter than usual in the Ongivinuk River.

Comparable counts were obtained between the principal ADF&G and USFWS observers (Tom Brookover and Mark Lisac) for several rivers and species, and are listed in Table 13. Aerial counts between observers did not differ considerably for sockeye and chinook salmon in most cases, but did differ for some chum salmon counts.

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Table 1. Aerial survey counts of sockeye salmon, Alagnak River system, 1992.

System Location	Number of Fish				Percent of Total
	Spawning	Dead	Schooled	Total	
Nonvianuk River	0	0	0	0	0
Nonvianuk Lake:					
South Beach	0	0	200	200	0
North Beach	600	0	500	1,100	0
Kulik River	14,900	447	18,500	33,847	15
Kulik Lake:					
South Beach	0	0	1,400	1,400	1
North Beach	0	0	500	500	0
Alagnak River	0	0	0	0	0
Kukaklek Lake:					
South Beach	0	0	300	300	0
North Beach	400	0	100	500	0
Nanuktuk Creek	38,000	1,140	9,700	48,840	22
Battle River	19,200	1,344	15,200	35,744	16
Battle Lake:					
South Beach	800	0	200	1,000	0
North Beach	400	0	100	500	0
Spectacle Creek	35,600	1,068	32,900	69,568	31
Funnel Creek	24,800	744	7,600	33,144	15
Total	134,700	4,743	87,200	226,643	100

Table 2. Aerial survey counts of chinook, chum, pink, and coho salmon, Naknek-Kvichak District, 1992.

Location	Survey Date	Number of Salmon			
		Chinook	Chum	Pink	Coho
Kvichak River	Aug. 13	264			
Alagnak River	Aug. 10	3,042	114,000	15,000	
Naknek River:					
Paul's Creek	Aug. 01	88	10 ^a		
King Salmon Creek	Aug. 09	158	35 ^a		
Big Creek	Aug. 18	895			
Mainstem Naknek R.	Aug. 27	1,550			
Total		5,997	114,045	15,000	

^a Incidental observation.

Table 3. Aerial survey peak counts of chinook salmon escapement, Egegik District, 1992.

Location	Survey	Date	Number of Chinook Salmon
Egegik River		Aug. 06	15
Shosky Creek		Aug. 06	143
Whale Mountain Creek		Aug. 06	52
Mossy Creek		Aug. 06	54
Mink Creek		Aug. 06	22
Gertrude Creek		Aug. 06	416
Kaye's Creek		Aug. 06	320
Takayoto Creek		Aug. 06	190
Angle Creek		Aug. 06	^a
Contact Creek		Aug. 06	296
Mainstem King Salmon River		Aug. 06	^a
Total			1,508

^a No counts made due to murky water.

Table 4. Aerial survey peak counts of chum salmon escapement, Egegik District, 1992.

Location	Survey Dates	Number of Chum Salmon
Egegik River	Aug. 06	50
Shosky Creek	Aug. 06	0
Whale Mountain Creek	Aug. 06	680
Mossy Creek	Aug. 06	15
Mink Creek	Aug. 06	25
Gertrude Creek	Aug. 06	4,500
Kaye's Creek	Aug. 06	400
Takayoto Creek	Aug. 06	0
Angle Creek	Aug. 06	^a
Contact Creek	Aug. 06	3,630
Mainstem King Salmon River	Aug. 06	200 ^a
Total		9,500

^a Murky water.

Table 5. Aerial survey peak counts of sockeye salmon escapement,
King Salmon and Dog Salmon Rivers, Ugashik District,
1992.

Location	Survey Date	Number of Sockeye Salmon
Ugashik River:		
Grassy Creek	Aug. 11	0
Subtotal		0
King Salmon River:		
Needle Lake	Aug. 11	1,500
Mother Goose Lake	Aug. 11	0
Painter Creek	Aug. 11	8,625
Mainstem King Salmon River	Aug. 11	3,300
Subtotal		13,425
Dog Salmon River:		
Figure-Eight Creek	Aug. 11	4,550
Goblet Creek	Aug. 11	0
Oldham Creek	Aug. 11	2,500
Wandering Creek	Aug. 11	740
Mainstem Dog Salmon River	Aug. 11	20
Subtotal		7,810
Grand Total		21,235

Table 6. Peak survey counts of chinook salmon escapement, Ugashik District, 1992. All counts from aerial surveys unless otherwise noted.

Location	Survey Date	Number of Chinook Salmon
King Salmon River System:		
Old Creek	Aug. 11	815
Pumice Creek	Aug. 11	750
Painter Creek	Aug. 11	855
Mainstem King Salmon River	Aug. 11	1,260
Mother Goose Lake	Aug. 11	0
Indecision Creek	Aug. 11	0
Volcano Creek	Aug. 11	^a
Subtotal		3,680
Dog Salmon River System:		
Figure-Eight Creek	Aug. 11	765
Goblet Creek	Aug. 11	56
Oldham Creek	Aug. 11	0
Wandering Creek	Aug. 11	0
Mainstem Dog Salmon River	Aug. 11	0
Subtotal	Aug. 11	821
Ugashik River System:		
Mainstem Ugashik River	July 29	90 ^b
Grassy Creek	Aug. 11	110
Subtotal		200
Grand Total		4,701

^a No counts made due to murky water.

^b Tower count.

Table 7. Peak survey counts of chum salmon escapement, Ugashik District, 1992. All counts from aerial surveys unless otherwise noted.

Location	Survey Date	Number of Chum Salmon
King Salmon River System:		
Old Creek	Aug. 11	15,000
Pumice Creek	Aug. 11	14,000
Painter Creek	Aug. 11	4,000
Mainstem King Salmon River	Aug. 11	8,525
Mother Goose Lake	Aug. 11	0
Indecision Creek	Aug. 11	0
Needle Lake	Aug. 11	0
Subtotal		41,525
Dog Salmon River System:		
Figure-Eight Creek	Aug. 11	650
Goblet Creek	Aug. 11	5
Oldham Creek	Aug. 11	150
Wandering Creek	Aug. 11	405
Mainstem Dog Salmon River	Aug. 11	0
Subtotal		1,210
Ugashik River System:		
Mainstem Ugashik River	July 29	60 ^a
Grassy Creek	Aug. 11	400
Subtotal		460
Grand Total		43,195

^a Tower count.

Table 8. Peak aerial live counts and total escapement estimates of sockeye salmon, Wood River system, 1992.¹

Area	<u>Aerial Counts</u> ²		<u>Total Escapement Estimate</u>	
	Date	Number	Number	Percent
Wood River	8/17	6,500	9,800	0.8
<u>Lake Aleknagik</u>				
Eagle Creek	8/10	70 ^a		
Hansen Creek	8/03	3,700 ^a		
Happy Creek	8/07	4,400 ^a		
Bear Creek	8/06	2,500 ^a		
Yako Creek	8/02	2,850 ^a		
Whitefish Creeks	8/13	340 ^a		
Ice Creek	8/09	6,560 ^{ab}		
Mission Creek	8/16	630 ^a		
Sunshine Creek	8/06	1,850		
Northshore Beaches	9/08	4,000 ^c		
Southshore Beaches	9/08	400 ^c		
Yako Beach	9/08	1,700		
Youth Creek		-		
Total		29,000	209,600	16.3
Agulowak River & lower River Bay	9/08	31,000	94,000	7.3
<u>Lake Nerka</u>				
Fenno Creek	8/11	3,380 ^a		
Upper River Bay Beaches, NW	9/08	1,000		
Upper River Bay Beaches, SE	9/08	2,700		
Allan Cr. to Ross Cr. Beaches	9/08	14,000		
Pike Creek	8/06	1,200		
Stovall Creek ²	8/06	500		
Bear Creek ²	8/06	50		
Teal Creek	8/06	450		
N4 to River Bay Beach	9/08	700		
N4-N6 Beach	9/08	14,500		
Pick Creek Beach	9/08	1,900		
Pick Creek	8/13	5,650 ^a		
Elva Creek Beach	9/08	640		
Elva Creek		-		
Amakuk Arm Beaches	9/08	400		
Amakuk Arm Beach - Ott's Bay Beach	9/08	2,400		
Ott's Bay Beaches	9/08	2,700		
Kema Creek ²	8/06	3,500		
Kema Creek Lake Beaches ²		-		

(continued)

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Area	<u>Aerial Counts²</u>		<u>Total Escapement Estimate</u>	
	Date	Number	Number	Percent
<u>Lake Nerka (continued)</u>				
Hidden Lake Creek ²	8/06	650		
Hidden Lake Beaches ²		-		
Anvil Bay Beaches	9/08	9,600		
Anvil Bay Beach - Elbow Pt. Beach	9/08	4,600		
Elbow Pt. Beach - Lynx Cr. Beach	9/08	6,050		
Lynx Cr.- Teal Cr. Beaches	9/08	850		
Lynx Creek	8/27	1,110 ^a		
Lynx Lake Beaches	9/08	4,300		
Total		82,830	598,600	46.5
Little Togiak River	8/17	5,500	8,200	0.6
<u>Little Togiak Lake</u>				
Northshore Beaches	9/08	1,200		
Southshore Beaches	9/08	850		
D Slough Beach	9/08	1,200		
Total		3,250	23,500	1.8
Agulukpak River	9/09	35,000	106,000	8.2
<u>Lake Beverley</u>				
Hardluck Bay Beaches	9/08	8,150		
Sam's Beach	9/08	800		
Golden Horn Beaches	9/08	850		
Silver Horn Beaches	9/08	5,000		
B12 & B9 Beaches	9/08	1,700		
Tsun Creek	8/17	130		
Moose Creek	8/12	1,680 ^{ab}		
Hope Creek	8/17	1,090 ^c		
Hope Creek Lake Beach	8/17	200		
Total		19,600	141,600	11.0
Peace River	8/17	1,450	2,900	0.2

(continued)

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Area	<u>Aerial Counts</u> ²		Total	
	Date	Number	<u>Escapement Estimate</u>	
			Number	Percent
<u>Lake Mikchalk</u>				
Narrows	9/09	200		
Northshore Beaches	9/09	200		
Southshore Beaches	9/09	<u>800</u>		
Total		1,200	8,650	0.7
Wind River	8/17	500	1,000	0.1
<u>Lake Kulik</u>				
K5 Creek - Grant River Beaches	9/09	550		
Grant River to K2 Creek Beaches	9/09	5,350		
Southshore Beaches	9/09	1,450		
K1 and K2 Creeks	8/17	<u>2,090</u>		
Total		9,440	68,200	5.3
Grant River	8/17	7,100	14,200	1.1
Total		232,370	1,286,250	100.0

¹ All counts rounded to nearest 10 fish.

² Lake access blocked by beaver dams.

^a Ground survey counts conducted by F.R.I., University of Washington.

^b Partial count; entire stream not surveyed.

^c Includes carcass count due to late survey.

Table 9. Peak aerial live counts and total escapement estimates of sockeye salmon, Togiak District, 1992.

Stream	<u>Aerial Counts</u>		<u>Total Escapement Estimate</u>	
	Date	Number	Factor ¹	Number
TOGIK SECTION				
Togiak Tower				199,056
Togiak River (Mainstem)	8/12	3,030	2.0	6,060
Gechiak Lake System	8/12	1,280	2.5	3,200
Pungokebuk Lake System	8/12	1,400	2.0	2,800
Nayorurun River ²				
Kemuk River ²				
Ongivinuck Lake System	8/12	2,200	2.0	4,400
Subtotal		7,910		16,460
KULUKAK SECTION				
Kulukak River	8/12	1,480	3.0	4,440
Kulukak Lake	7/16	6,050	2.0	12,100
Tithe Creek Ponds	8/12	4,950	2.0	9,900
Subtotal		12,480		26,440
MATOGAK, OSVIK, and CAPE PIERCE SECTIONS				
Matogak River ³	7/28	300	2.0	600
Osivik River ⁴	8/07	3,340	2.0	6,680
Slug River ³	7/28	1,460	2.0	2,920
Subtotal		5,100		10,200
OTHER RIVERS				
Quigmy River ³	7/28	40	2.0	80
Negukthlik River ⁴	8/06	3,600 ^a	2.0	7,200
Ungalikthluk River ³	7/28	3,760	2.0	7,520
Subtotal		7,400		14,800
Total		32,890		266,956

¹ Derived by expanding peak live count to reflect fish not counted due to variables such as schooled and dead fish, late or poor survey conditions, bad weather, etc.

² No aerial surveys conducted.

³ Sockeye salmon count obtained during chinook and chum salmon surveys.

⁴ USFWS observer count.

^a Count includes 2,000 schooled fish.

Table 10. Peak aerial live counts and total escapement estimates of chinook salmon, Togiak District, 1992.

Stream	<u>Aerial Counts</u>		<u>Total Escapement Estimate</u>	
	Date	Number	Factor ¹	Number
TOGIAC SECTION				
Togiak River Mainstem				
A	8/7	150	2.5	375
B	8/7	250	2.5	625
C	8/7	440	2.5	1,100
D	8/7	225	2.5	563
E	8/7	450	2.5	1,125
F	8/7	690	2.5	1,725
Subtotal		2,205		5,513
Gechiak River	8/7	250	2.5	625
Pungokepuk River	8/7	160	2.5	400
Nayorurun River	8/7	70	2.5	175
Kemuk River	8/7	175	2.5	438
Ongivinuck River	8/7	105	2.5	263
Subtotal		2,965	2.5	7,413
KULUKAK SECTION				
Kulukak River	8/7	485	2.5	1,213
MATOGAK, OSVIAK, and CAPE PIERCE SECTIONS				
Matogak River	7/28	40	2.5	100
Osviak River	7/28	105	2.5	263
Slug River	7/28	30	2.5	75
Subtotal		175		438
OTHER RIVERS				
Quigmy River	7/28	15	2.5	38
Negukthlik River ²	8/07	490	2.5	1,225
Ungalikthluk River	7/29	35	2.5	88
Subtotal		540		1,350
Total		4,165		10,413

¹ Derived by expanding peak live count to reflect fish not counted due to variables such as schooled and dead fish, late or poor survey conditions, bad weather, etc.

² USFWS estimate.

Table 11. Peak aerial live counts and total escapement estimates of chum salmon, Togiak District, 1992.

Stream	<u>Aerial Counts</u>		<u>Total Escapement Estimate</u>	
	Date	Number	Factor ¹	Number
TOGIK SECTION				
Togiak River Mainstem				
A	8/7	1,800		
B	8/7	1,800		
C	8/7	300		
D	8/7	100		
E	8/7	1,200		
F	8/7	1,500		
Subtotal		6,700		
Gechiak River	8/7	2,000		
Pungokebuk River	8/7	500		
Nayorurun River	8/7	1,800 ^a		
Kemuk River	8/7	900 ^a		
Ongivinuck River	8/7	800 ^a		
Subtotal ²	8/7	12,700		
	7/15	22,700	3.0	68,100
KULUKAK SECTION				
Kulukak River ²	8/7	2,800		
	7/22	4,800	3.0	14,400
MATOGAK, OSVIAK, and CAPE PIERCE SECTIONS				
Matogak River	7/28	4,400	2.0	8,800
Osviak River	7/28	7,100	2.0	14,200
Slug River ²	7/28	1,700	3.0	5,100
Subtotal		13,200		28,100
OTHER RIVERS				
Quigmy River	7/28	600	2.0	1,200
Negukthlik River	7/29	100	2.0	200
Ungalikthluk River	7/29	4,000	2.0	8,000
Subtotal		4,700		9,400
Total		45,400		120,000

¹ Derived by expanding peak live count to reflect fish not counted due to variables such as schooled and dead fish, late or poor surveys conditions, bad weather, etc.

² Management survey prior to the peak of spawning was used to estimate escapement, due to late timing of the spawning ground survey.

^a Includes carcass counts.

Table 12. Peak aerial live counts and total escapement estimates of coho salmon, Togiak District, 1992.

Stream	<u>Aerial Counts</u>		<u>Total Escapement Estimate</u>	
	Date	Number	Factor ¹	Number
TOGIAK SECTION				
Togiak River Mainstem				
A	10/5	4,420	3.0	13,260
B	9/30	1,120	3.0	3,360
C	9/30	1,180	3.0	3,540
D	9/30	540	3.0	1,620
E	9/30	2,940	3.0	8,820
F	9/30	3,080	3.0	9,240
Subtotal		13,280	3.0	39,840
Gechiak River	9/30	5,240	3.0	15,720
Pungokepuk River	10/5	1,440	3.0	4,320
Nayorurun River	10/5	780	3.0	2,340
Kemuk River	10/5	1,500	3.0	4,500
Ongivinuck River	9/30	4,460	3.0	13,380
Subtotal		26,700	3.0	80,100
KULUKAK SECTION				
Kulukak River	9/30	12,640	3.0	37,920
MATOGAK, OSVIK, and CAPE PIERCE SECTIONS				
Matogak River ²				
Osviak River ²				
Slug River ²				
Subtotal				
OTHER RIVERS				
Quigmy River ²				
Negukthlik River ²				
Ungalikthluk River ²				
Subtotal				
Total		39,340		118,020

¹ Derived by expanding peak live count to reflect fish not counted due to variables such as schooled and dead fish, late or poor survey conditions, bad weather, etc.

² No aerial surveys conducted.

Table 13. Comparison of peak aerial counts of spawning salmon between ADF&G and USF&WS observers, Bristol Bay, 1992.^a

Location	Date	Chum Salmon		Chinook Salmon		Sockeye Salmon		All Salmon Species	
		ADF&G	USF&WS	ADF&G	USF&WS	ADF&G	USF&WS	ADF&G	USF&WS
Quigmy River	7/28	600	740	15	32	40	80	655	852
Matogak River	7/28	4,400	1,640	40	33	300	500	4,740	2,173
Osviak River	7/28	7,100	4,680	105	65	1,550	1,400	8,755	6,145
Slug River	7/28	1,700	1,300	30	39	1,460	1,040	3,190	2,379
Ungalikthluk River	7/28	4,000	3,660	35	35	3,760	2,620	7,795	6,315
Negukthlik River	7/28	100	360	230	225	1,320 ^b	460		
Togiak River									
Ongiv. R. - Tog. L.	8/7			690	410				
Ongiv. River	8/7			105	294				
Total		17,900	12,380	1,250	1,133	7,110	5,640	25,135	17,864

^a ADF&G observer - T. Brookover; USF&WS observer - M. Lisac.

^b Includes schooled fish.

APPENDIX TABLES 1-35

Appendix Table 1. Sockeye salmon total escapement estimates, Naknek-Kvichak District, 1955-1992. Estimates based on visual counts from towers unless otherwise noted.

Year	Escapement				Alagnak Percent of Total
	Kvichak	Naknek	Alagnak	Total	Total
1955	250,546	278,500 ^b	171,500 ^a	700,546	24
1956	9,443,318	1,772,595 ^b	784,000 ^a	11,999,913	7
1957	2,842,810	634,655 ^b	126,595	3,604,060	4
1958	534,785	278,118	94,650	907,553	10
1959	680,000	2,231,807	825,431	3,737,238	22
1960	14,630,000	828,381	1,240,530	16,698,911	7
1961	3,705,849	351,078	90,036	4,146,963	2
1962	2,580,884	723,066	90,630	3,394,580	3
1963	338,760	905,358	203,304	1,447,422	14
1964	957,120	1,349,604	248,700	2,555,424	10
1965	24,325,926	717,798	175,020	25,218,744	1
1966	3,775,184	1,016,445	174,336	4,965,965	4
1967	3,216,208	755,640	202,626	4,174,474	5
1968	2,557,440	1,023,222	193,872	3,774,534	5
1969	8,394,204	1,331,202	122,490	9,847,896	1
1970	13,935,306	732,502	177,060	14,844,868	1
1971	2,387,392	935,754	187,302	3,510,448	5
1972	1,009,962	586,518	151,188	1,747,668	9
1973	226,554	356,676	35,280	618,510	6
1974	4,433,844	1,241,058	214,848	5,889,750	4
1975	13,140,450	2,026,686	100,480	15,267,616	1
1976	1,965,282	1,320,750	81,822	3,367,854	2
1977	1,341,144	1,085,856	100,000 ^a	2,527,000	4
1978	4,149,288	813,378	229,400 ^a	5,192,066	4
1979	11,218,434	925,362	294,200 ^a	12,437,996	2
1980	22,505,268	2,644,698	297,900 ^a	25,447,866	1
1981	1,754,358	1,796,220	82,210 ^a	3,632,788	2
1982	1,134,840	1,155,552	239,300 ^a	2,529,692	9
1983	3,569,982	888,294	96,220 ^a	4,554,496	2
1984	10,490,670	1,242,474	215,370 ^a	11,948,514	2
1985	7,211,046	1,849,938	118,030 ^a	9,179,014	1
1986	1,179,322	1,977,645	230,180 ^a	3,387,147	7
1987	6,065,880	1,061,806	154,210 ^a	7,281,896	2
1988	4,065,216	1,037,862	194,630 ^a	5,297,708	4
1989	8,317,500	1,161,984	196,760 ^a	9,676,244	2
1990	6,970,020	2,092,578	168,760 ^a	9,231,358	2
1991	4,222,788	3,578,508	277,589 ^a	8,078,885	3
1992	4,725,864	1,606,650	226,643 ^a	6,559,157	3
Mean	5,662,908	1,208,367	232,066	7,103,341	3

^a Aerial survey index counts.

^b Weir counts.

Appendix Table 2. Aerial survey index counts of chinook salmon escapements, Naknek River drainage, 1970-1992.

Year	Mainstem Naknek River	Paul's Creek	King Salmon Creek	Big Creek	Total
1970	3,060		260	825	4,145
71	1,639	52	704	490	2,885
72	351	156	1,224	1,060	2,791
73	1,315		115	1,106	2,536
74		91	495	860	1,446
1975	2,250	144	279	779	3,452
76	5,950	31	180	970	7,131
77	4,830		1,860		6,690 ^a
78					^a
79					
1980	300	17		30	347
81	2,890		591	790	4,271
82	5,360	340	980	1,930	8,610
83	2,860	290	460	4,220	7,830
84	790	400	385	3,420	4,995
1985	590				590
86	2,200	73	102	1,542	3,917
87	2,800	7	290	1,353	4,450
88	7,380	150	600	3,600	11,730
89	1,700	50	100	860	2,710
1990	4,500	150	350	2,000	7,000
91	1,655	121	275	2,340	4,391
92	1,550	88	158	895	2,691
Total	53,970	2,160	9,408	29,070	94,608
Mean Index	2,699	135	495	1,530	4,859 ^b
Percent	56	3	10	32	100

^a Sum of mean indices.

^b Non-expanded index counts unavailable.

Appendix Table 3. Chinook salmon escapement survey history, Mainstem Naknek River, 1929-1992.

Year	Count Dates	Surveyor	Actual Weir Count ¹	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate ²	Comments
1929	7/03-7/31		1,498			Peak count 7/27.
1930	6/20-8/09		1,999			Peak count 8/09.
1931	6/17-8/09		896			Peak count 8/07.
1932	6/23-8/10		1,869			
1950	7/08-8/20		3,097			Peak count 8/09.
1951	6/28-8/07		1,876			Peak count 8/04.
1952	6/25-8/10		633			Peak count 8/06.
1953	6/24-8/10		2,074			Peak count 7/26.
1954	6/20-8/11		3,474			Peak count 8/10.
1955	6/13-8/17		4,188			Peak count 8/16.
1956	6/22-8/28		7,378			Peak count 8/18.
1957	6/28-8/04		8,504			Peak count 8/03.
1966	8/26	Redick				300 counted via skiff.
1967	Mid August	Paddock			800	
1968					1,200	Conservative estimate.
1969					1,200	
1970	7/31	Whitehead		845		
	8/03	Siedelman		3,060		Visibility very good.
	8/22	Siedelman		1,540	1,750	Pre-peak. River murky.
	8/22	Whitehead		1,310		
	8/25	Whitehead		2,225		Optimal count conditions.
	8/25	Siedelman		2,536	2,500	Pre-peak. Good vis.
1971	8/26	Cunningham		1,639		Most @ Rapids. Few dead
1972	8/23	Cunningham		351		Post-peak. Poor vis.
1973	8/19	Russell		1,315		Near peak. Good vis.
1974	8/19	Russell			450	Fish deep. Accuracy ??.
1975	8/17	Russell		2,250		Peak near. Good vis.
1976	8/13	Bill		2,615		Near peak. Few dead.
	8/16	Russell		5,950	7,250	Pre-peak. Large schools.
1977	8/22	Russell		4,830	5,750	Pre-peak. Few dead.
1978	8/09	Gwartney			4,000	Near peak.
1979		Gwartney			1,750	
1980	8/08	Bill		300	500	
1981	8/26	Bill		2,890	3,470	At peak. Good vis.
1982	8/07	Bill		570	1,000	Pre-peak. Many schooled.
	8/19	Bill		5,360	5,400	
1983	8/14	Bill		2,860	3,000	Pre-peak. Still schooled.
1984	8/14	Bill		790	2,370	
1985	8/06	Bill			600	Pre-peak.
	8/27	Bill		590	700	
1986	8/18	Russell		1,990		Pre-peak. Many schooled.
	8/19	Meyer		2,200		Peak near.
1987	8/19	Meyer		2,800		Pre-peak. Still schooled.
	8/28	Bill		2,655	2,855	
1988	8/09	Minard		7,380	7,400	Near peak. Most on redds.
1989	8/14	Minard		1,700		Fish spawning. Few dead.
1990	8/06	Minard		4,500		
1991	8/20	Russell		1,655		Pre-peak. Many schooled.
1992	8/21	Regnart		877		Poor visibility in holes.
	8/27	Regnart		1,550		At peak. All on redds.
Totals			37,486	53,970*		
Mean			3,124	2,699		

¹ Weir count provides no estimate of 15-20% of population spawning downstream of weir site, or the fish passing before and after weir in operation.

² Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

* Includes only largest index count each year.

Appendix Table 4. Chinook salmon escapement survey history, Big Creek, Naknek River drainage, 1963-1992.

Year	Count Dates	Surveyor	Float Count	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate ¹	Comments
1963	8/01	Paddock		362		Heli. Covered 1/2 stream.
	8/13	Paddock		1,345	2,690	Near peak. Good vis.
1964	7/31	Paddock		448		Too early.
	8/15	Siedelman		636		Helicopter. Near peak.
	8/15-8/18	Siedelman	1,130			Past peak.
1965	8/05-8/08	Andrews	578			Fair survey.
1966	8/13-8/16	Redick	979			At peak. Fair vis.
1967	8/10-8/14	Whitehead	1,129			Some aband. redds.
1968	8/10-8/14	Meyers	3,827			Conditions fair to poor.
1969	8/12-8/14	Parkinson	1,012			High murky waters.
	Mid-August				5,000	
1970	7/19	Whitehead		825		
	8/15-8/17	Parkinson	1,601			2/3 stream high & murky.
1971	8/13	Cunningham		490	1,200	Only upper 1/3 surveyed.
	8/28	Siedelman		277		Past peak. 30+ mph winds.
1972	8/08	Cunningham		695		Pre-peak.
	8/18	Siedelman		1,060		Past peak.
1973	8/17	Russell		1,106		At peak. Lots w/fungus.
1974	8/01	Russell		520	850	Pre-peak. No dead.
	8/11	Russell		860	1,250	Near peak. Didn't include lower 8 mi. of stream where 150 more were seen Aug 10.
1975	8/09	Russell		779		Pre-peak.
1976	8/13	Bill		970	1,400	Partial stream coverage.
1977		Gwartney			2,700	
1978	8/07	Gwartney			4,800	Good vis. Fish all over.
1979		Gwartney			3,650	
1980	8/08	Bill		30	120	High muddy water.
1981	8/26	Bill		790	3,950	Muddy. Lots of carcasses.
1982	8/07	Bill		1,930	6,900	At peak.
1983	8/14	Bill		4,220	9,000	
1984	8/08	Bill		3,420	8,800	At peak of spawning.
1985	8/06	Bill			2,900	Poor survey conditions.
1986	8/08	Meyer		1,542	6,000	At peak. Excellent vis.
1987	8/21	Meyer		1,353	2,500	
1988	8/09	Minard		3,600		
1989	8/14	Minard		860		
1990	8/06	Minard		2,000		
1991	8/12	Regnart		2,340		At peak. All on redds.
1992	8/18	Regnart		895		Past peak. Includes 125 dead.
Totals			10,256	31,051 ^a		
Mean			1,465	1,479		

¹ Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

^a Includes only largest index count each year.

Appendix Table 5. Chinook salmon escapement survey history, King Salmon Creek, Naknek River drainage, 1964-1992.

Year	Count Dates	Surveyor	Float Count	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate ¹	Comments
1964	7/31	Paddock		378		Helicopter. Survey fair.
	8/11	Paddock		55		Helicopter. Poor vis.
	8/11-8/14	Paddock	104			Past peak. Turbid.
1966	7/31-8/03	Redick	633			At or near peak.
1967	7/24-7/26	Paddock	289		600	Poor visibility.
1968	7/17	Whitehead		282		Helicopter. Pre-peak.
	7/17	Meyers		242		Helicopter. Pre-peak.
	7/20	Whitehead		868		H-21 heli. Good survey
	7/20	Meyers		575		H-21 heli. Good survey
	7/20-7/23	Whitehead	2,204			Count conditions optimal.
1969	7/23-7/25	Parkinson	2,722			Pre-peak. Survey fair.
1970	7/19	Whitehead		260		Pre-peak. Poor vis.
1971	7/28	Cunningham		704		Good visibility.
1972	7/29	Siedelman		1,224		At spawning peak.
1973	8/01	Siedelman		115		Past peak. Vis fair.
1974	7/15	Russell		164	350	Pre-peak. Fish in pools.
	7/28	Russell		495	625	At/near peak. Good vis.
1975	7/28	Russell		279	375	Pre-peak. Good vis.
	8/10	Russell	67			Lower 12 miles of stream
	8/17			0		Spawning over. Good Vis.
1976	8/03	Bill		180	400	Peak within next 3 days.
1977	7/29	Russell		1,860	2,350	At spawning peak.
1978	8/09	Gwartney			350	Past peak. Good survey.
1979		Gwartney			1,750	
1980	8/08	Bill				Creek too murky to count.
1981	7/30	Russell		591	1,500	At peak. Vis fair/poor.
1982	8/07	Bill		980	3,920	Good visibility.
1983	8/14	Bill		460	1,400	30% dead. Poor vis.
1984	8/08	Bill		385	1,155	
1985	8/06	Bill			500	
1986	8/08	Meyer		70		Poor survey conditions.
	8/11	Meyer		102	284	Past peak. Fair survey.
1987	8/13	Russell		290	800	Past peak. Poor vis.
						Est. based on jet boat trip, carcass samplers
	8/21	Meyer		13	33	Past peak by 2 weeks.
1988	8/08	Minard		600		At peak.
1989	8/14	Minard		100		Past peak.
1990	8/06	Minard		350		
1991	7/30	Russell		100		Pre-peak. Survey fair.
	8/05	Russell		275		At peak. Fish on redds.
1992	8/09	Russell		158		Past peak. Incl 47 dead
Totals			5,952	10,654 ^a		
Mean			1,190	507		

¹ Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

^a Includes only largest index count each year.

Appendix Table 6. Chinook salmon escapement survey history, Paul's Creek, Naknek River drainage, 1971-1992.

Year	Count Dates	Surveyor	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate ¹	Comments
1971	7/28	Cunningham	52		
1972	7/28	Siedelman	156		Pre-peak.
1973	8/01	Siedelman			Too murky to survey.
1974	7/15	Russell	2		
	7/26	Russell	91	250	Pre-peak.
1975	7/28	Russell	144	225	Pre-peak. Good vis.
1976	8/03	Bill	31	100	At peak. Poor vis.
1977					No count.
1978	8/09	Gwartney		300	Past peak. 75% dead.
1979					No count.
1980	8/08	Bill	17		All carcasses. Murky.
1981					No count.
1982	8/07	Bill	340	1,020	Near peak. Good vis.
1983	8/14	Bill	290	800	Poor visibility.
1984	8/08	Bill	400	800	Fair vis. 25% dead.
1985	8/06	Bill		170	Pre-peak.
1986	8/08	Meyer	73	236	Approx 30% dead already.
1987	8/13	Russell	7		Past peak. Poor survey vis.
		Meyer		400	Estimate based on jet boat trip by carcass samplers.
1988	8/08	Minard	150		At peak.
1989	8/14	Minard	50		Past peak. Excellent vis.
1990	8/06	Minard	150		Excellent survey conditions.
1991	7/30	Russell	121		Slightly pre-peak.
1992	8/01	Russell	88		Slightly pre-peak.
Totals			2,160 ^a		
Mean			135		

¹ Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

^a Includes only largest index count each year.

Appendix Table 7. Chinook salmon escapement survey history, Alagnak River, 1963-1992.

Year	Count Dates	Surveyor	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate ¹	Comments
1963	8/12	Siedelman	551		Good vis. No side-chan counts.
1966	8/06	Redick	13		Poor vis. Floated Nonv. R. & mainstem 8/06-8/10 & saw 238.
	8/11	Redick	1,465		Pre-peak. Still upmigrating.
1967	8/16	Van Valin	1,250		
1968	8/18	Siedelman	6,717	8,500	Fairly good survey.
1969	8/19	Siedelman	4,781	6,000	Marginal vis., 20 kn NW winds.
1970	8/22	Siedelman	5,250	5,000	Peak of spawning. Good vis.
	8/22	Whitehead	4,590		Peak of spawning. Good vis.
1971	8/25	Siedelman	1,420	1,500	High water but count okay.
	8/25	Cunningham	1,475		Survey trainee w/Siedelman.
1972	8/23	Cunningham	2,256	2,400	Past peak. Many dead.
1973	8/16	Russell	824	1,250	Near peak. No dead noted.
1974	8/13	Russell	1,411	1,700	Pre-peak.
	8/19	Russell	1,596	1,900	Near peak.
1975	8/17	Russell	6,620	7,250	Pre-peak by about 1 week.
1976	8/16	Bill	7,593	8,750	Pre-peak. Few dead.
1977	8/18	Bill	3,634	12,000	Pre-peak. No count from Pfaff Pond on downstream.
	8/18	Sanders	9,425		Survey trainee w/Bill. Pond downstream.
1978	8/24	Bill	11,650	25,100	
1979					No survey.
1980	8/08	Bill	2,020	5,090	Pre-peak. Fog @ lower river.
	8/21	Bill	2,930	5,860	
1981	8/26	Bill	2,430	8,540	
1982	8/09	Bill	3,400	4,700	At least a week pre-peak.
	8/19	Bill	3,350	5,480	At peak.
1983	8/15	Bill	2,980	3,500	At peak.
1984	8/14	Bill	6,090	9,135	
1985	8/17	Bill	3,920	9,518	Near peak. About 30% dead.
1986	8/11	Bill	3,090	7,200	At peak.
1987	8/22	Bill	2,420	5,363	May be past peak. Lots dead.
1988	8/12	Bill	4,600	7,900	Near peak of spawning.
1989	8/15	Bill	3,650	5,400	About a week pre-peak.
	8/28	Bill	2,560	3,840	
1990	8/08	Bill	1,720	3,255	Pre-peak. Many fish schooled.
1991	8/09	Regnart	2,023		Pre-peak. Most fish schooled.
	8/19	Regnart	2,531		Near peak. Most on redds.
1992	8/10	Regnart	3,042		Pre-peak. Most fish schooled.
	8/21	Regnart	2,275		Near peak. Marginal vis.
Totals			98,360 ^a		
Mean			3,643		

¹ Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

^a Includes only largest index count each year.

Appendix Table 8. Chinook salmon escapement survey history, Kvichak River, 1932-1992.

Year	Count Dates	Surveyor	Actual Weir Count ¹	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate ²	Comments
1932	6/28-8/05		5,753			Peak count 7/05.
1976	8/16	Bill		35	45	Survey targeting pinks.
1980	8/08	Bill		900	1,000	Actively spawning.
1984	8/14	Bill		200		
1988	8/13	Bill		190	570	Nearly all on redds.
1989	8/16	Bill		100	260	
1990	8/19	Bill		170	510	
1992	8/13	Regnart		264		All fish on redds.
Totals			5,753	1,859 ^a		
Mean				266		

¹ Weir count provides no estimate of population spawning downstream of weir site, or fish passing before and after weir in operation.

² Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

^a Includes only largest index count each year.

Appendix Table 9. Chinook salmon escapement index data,
Naknek-Kvichak District, 1970-1992.

Non-expanded Escapement Indices by Drainage				
Year	Kvichak	Naknek	Alagnak	Total
1970		4,145 ^a	5,250	9,395
1971		2,885	1,420	4,305
1972		2,791	2,256	5,047
1973		2,536 ^a	824	3,360
1974		1,446 ^b	1,596	3,042
1975		3,452	6,620	10,072
1976	35	7,131	7,593	14,759
1977		6,690 ^a	3,634	10,324
1978		°	°	°
1979		°	°	°
1980	900	347 ^d	2,930	4,177
1981		4,271 ^a	2,430	6,701
1982		8,610	3,400	12,010
1983		7,830	2,980	10,810
1984	200	4,995	6,090	11,285
1985		590 ^c	3,920	4,510
1986		3,917	3,090	7,007
1987		4,450	2,420	6,870
1988	190	11,730	4,600	16,520
1989	100	2,710	3,650	6,460
1990	170	7,000	1,720	8,890
1991		4,391	2,531	6,922
1992	264	2,691	3,042	5,997
Totals	1,859	94,608	71,996	168,463
Mean	266	4,505	3,428	8,199 ^f

^l Includes aerial indices from all streams surveyed in drainage.

^a No index count for Paul's Creek.

^b No index count for Naknek River.

^c No non-expanded index counts exist for this year.

^d Includes only index counts for Naknek River & Paul's Creek.

^e Naknek River mainstem only.

^f Sum of mean indices.

Appendix Table 10. Chum salmon escapement survey history, Alagnak River, 1961-1992.

Year	Count Dates	Surveyor	Tower Count	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate ¹	Comments
1961			18,906			
1962			3,846			
1963	8/12	Siedelman	20,124	4,120		
1964			2,562			
1965			132			
1967			9,990			
1968			72			
1969			210			
1970			5,790			
1971			402			
1972			48			
1976	8/16	Bill		2,125	5,250	
1977	8/18	Bill		35,000		Only upper 1/2 river.
1978	8/24	Bill		9,900		
1980	8/21	Bill		7,300	14,600	
1981	8/26	Bill		75,000		
1982	8/09	Bill		14,000	42,000	
	8/19	Bill		12,000	30,000	
1983	8/15	Bill		8,800		Pre-peak.
1984	8/14	Bill		48,000	87,500	
1985	8/17	Bill		18,200	31,200	Includes 11,700 dead.
1986	8/11	Bill		41,400	107,000	Near peak. Lots of dead.
1987	8/22	Bill		7,800	39,000	Past peak. Lots dead.
1988	8/12	Bill		59,000		Pre-peak. Minimum est.
1989	8/15	Bill		3,700	4,000	
	8/28	Bill		6,000		
1990	8/08	Bill		8,500	30,000	Pre-peak.
	8/18	Bill		48,800		Near peak.
1991	8/09	Regnart		43,000		Pre-peak.
	8/19	Regnart		64,300		At peak of spawning.
1992	8/10	Regnart		114,000		Near peak.
Totals			39,330	563,745 ^a		
Mean			3,575	33,161		

¹ Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

^a Includes only largest index count each year.

Appendix Table 11. Pink salmon escapement survey history, Alagnak River, 1968-1992.

Year	Count Dates	Surveyor	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate ¹	Comments
1968	8/27	Siedelman	97,000	125,000	
1970					No survey.
1972					No survey.
1974	8/14	Bill	20,600		Big schools. Pre-peak.
1976	8/16	Bill	6,375	13,000	Pre-peak.
1978	8/24	Bill	330,300	736,000	Just starting to spawn.
1980	8/21	Bill	121,000	242,000	
1982	8/09	Bill	21,300	63,900	Pre-peak.
	8/19	Bill	24,800	43,000	Pre-peak.
1984	8/14	Bill	296,500	567,100	Pre-peak. Most schooled.
1986	8/11	Bill	48,600	145,800	
1988	8/12	Bill	415,000	620,000	Pre-peak.
1990	8/08	Bill	45,100		Pre-peak.
	8/18	Bill	240,500		Est. 1 week pre-peak.
1992	8/10	Regnart	15,000		Pre-peak.
Totals			1,615,675 ^a		
Mean			146,880		

¹ Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

^a Includes only largest index count each year.

Appendix Table 12. Pink salmon escapement survey history, Kvichak River, 1966-1992.

Year	Count Dates	Surveyor	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate ¹	Comments
1966		Robertson		67,500	
1968	8/26	Siedelman		88,000	
1970					No survey.
1972					No survey.
1974	8/14	Bill		30,560	
1976	8/16	Bill		16,100	Pre-peak.
1978	8/28	Bill	88,000	440,000	Still migrating & schooled.
1980	8/08	Bill	7,000	25,000	Still schooled.
1982					No survey.
1984	8/14	Bill	111,000	165,000	
1986					No survey.
1988	8/13	Bill	94,000		
1990	8/19	Bill	25,300	47,000	
1992					No survey.
Totals			325,300		
Mean			65,060		

¹ Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

Appendix Table 13. Pink salmon escapement survey history, Naknek River, 1974-1992.

Year	Count Dates	Surveyor	Non-expanded Aerial Index Count	Expanded Aerial Index Estimate ¹	Comments
1974	8/14	Bill	161,800	362,000	
1976	8/13	Bill	94,600	110,000	Pre-peak. Many schooled.
1978	8/24	Bill	312,000	780,000	
1980	8/08	Bill	80,000	160,000	Pre-peak.
1982	8/19	Bill	33,600	34,000	Pre-peak.
1984	8/14	Bill	27,000	125,000	
1986	8/18	Russell	286,000	375,000	Pre-peak. Most schooled.
1988	8/24	Russell	187,000		
1990	8/18	Bill		65,000	
1992					No survey.
Totals			1,182,000		
Mean			147,750		

¹ Subjective estimate by surveyor to adjust for uncounted portions of river, poor visibility in some areas, etc.

Appendix Table 14. Aerial survey index counts of chinook salmon escapement, Egegik District, 1981-1992.

Year	Egegik River	Shosky Creek	Gertrude Creek	Contact Creek	Takayoto Creek	Kaye's Creek	Other	Total
1981			515					515
1982	300		900	300				1,500
1983			860	375	380			1,615
1984	40	300	600	110	350			1,400
1985	75	80	260	95	315	230	25	1,080
1986	65	150	150	18	40	46	63	532 ^a
1987	15	174	408	88	232	284	78	1,279
1988	50	151	248	110	177	120	12	868
1989	14	90	310	100	300	120	63	997
1990	24 ^b	85	260	205	175	175	44	968
1991	0 ^b	62	83	73	95	117	123	553
1992	15	143	416	296	190	320	128	1,508
Total	598	1,235	5,010	1,770	2,254	1,412	536	12,815
Mean	60	137	418	161	225	177	67	1,244 ^c

^a Survey done 10 to 14 days later than normal.

^b Tower counts.

^c Sum of mean indices for all locations.

Appendix Table 15. Aerial survey index counts of chum salmon escapement, Egegik District, 1982-1992.

Year	Egegik River	Whale Mountain Creek	Gertrude Creek	Contact Creek	Takayoto Creek	Kaye's Creek	Other	Total
1982			12,000	2,000				14,000
1983			5,000	6,000	3,500			14,500
1984	800		13,000	10,000	2,400		200	26,400
1985	400	600	2,600	500	0	800	285	5,185
1986	0	6,025	140	15	5	3	25	6,213 ^a
1987	150	19,000	3,770	2,850	0	2,780	1,016	29,566
1988	500	4,400	5,200	3,200	0	1,600	200	15,100
1989	0	5,200	1,100	200	0	0	150	6,650
1990	72 ^b	4,875 ^c	2,975 ^c	1,050 ^c	0	80	150	9,202
1991	0	1,500	990	480	0	280	170	3,420
1992	50	680	4,500	3,630	0	400	240	9,500
Total	1,972	42,280	51,275	29,925	5,905	5,943	2,436	139,736
Mean	219	5,285	4,661	2,720	591	743	271	14,490 ^d

^a Survey done 10 to 14 days later than normal.

^b Tower counts.

^c Total derived by adding Aug. 02 count to one half the counts obtained on Aug. 07, 12, 17, and 28.

^d Sum of mean indices for all locations.

Appendix Table 16. Aerial survey index counts of pink salmon escapement, Egegik District, 1982-1992.

Year	Number of Surveys	Pink Salmon Count	Comments
1982	2	15,000	Spawning in Egegik River "Rapids" on Aug. 26
1983	0	58	Counted during float trip of Gertrude Creek.
1984	3	17,000	Peak count for Egegik River was 13,000 on Aug. 31.
1985	3	0	
1986	1	2,500	Count made Aug. 19.
1987	6	0	
1988	6	23,000	Peak count made Sept. 7.
1989	8	300	
1990	6	17,000	Peak count made on August 23.
1991	1	0	
1992	0		No surveys done targeting pink salmon.

Appendix Table 17. Aerial survey index counts of coho salmon escapement, Egegik District, 1981-1992.

Year	Number of Surveys	Coho Salmon Count	Comments
1981	1 ^a	4,000	Only Becharof tributaries surveyed.
1982	1	20,000	Surveyed on Aug. 20
1983	0		No surveys done
1984	3	43,225	40,000 counted in Ege. Lagoon on Aug. 15
1985	3	5,260	Peak survey on Aug. 26
1986	1	12,575	Surveyed Aug. 19
1987	6	6,930	Included King Salmon River & tributaries.
1988	6	13,715	Included King Salmon River & tributaries.
1989	9	4,485	Included Gertrude & Whale Mtn Creeks.
1990	7	13,400	Peak survey on Aug. 17
1991	0	220	Incidental observation made Aug. 06.
1992	0	200	Incidental obs. in Egegik River Aug. 6.

^a Survey done by USFWS personnel.

Appendix Table 18. Aerial survey index counts of chinook salmon escapement, Ugashik District, 1980-1992.

Year	Ugashik River	Dog Salmon River ^a	King Salmon River	Painter Creek	Pumice Creek	Old Creek	Total
1980			900	1,000			1,900
1981			50	300			350
1982			700	700			1,400
1983	50	965	525	635	1,800	660	4,635
1984	108 ^b	840	4,100	1,880	1,100	880	8,908
1985	200 ^c	560	4,601	410	930	410	7,111
1986	66 ^c	252	1,777	646	705	739	4,185
1987	138 ^c	751	981	1,051	1,602	1,155	5,678
1988	249 ^d	900	5,820	1,170	1,025	660	9,824
1989	226 ^{cd}	848	1,670	1,030	510	520	4,804
1990	55 ^d	540	1,500	590	450	610	3,745
1991	91 ^{bd}	449	700	365	375	420	2,400
1992	200 ^{bd}	821	1,260	855	750	815	4,701
Total	1,383	6,926	24,584	10,632	9,247	6,869	59,641
Mean	106	693	1,891	818	925	687	5,120 ^e

^a Includes Figure Eight, Goblet, Oldham, & Wandering Creeks.

^b Tower Counts.

^c Includes tower count plus later aerial survey count.

^d Includes Grassy Creek (tributary downstream of Ugashik Lagoon).

^e Sum of mean indices for all locations.

Appendix Table 19. Aerial survey index counts of chum salmon escapement, Ugashik District, 1980-1992.

Year	Ugashik River	Dog Salmon River ^a	King Salmon River	Painter Creek	Pumice Creek	Old Creek	Other	Total
1980	18 ^b		7,000	3,000				10,018
1981	0 ^b		200					200
1982	12 ^b		19,000	35,000			650	54,662
1983	0 ^b	3,150	2,700	4,000	20,000 ^e	3,300		33,150
1984	132 ^b	750	119,000	16,000	16,000	14,500	2,500	168,882
1985	42 ^d	350	20,000	1,925	6,000	670	300	29,287
1986	0 ^d	120	8,650	1,200	2,000	630	125	12,725
1987	130 ^d	340	9,750	2,290	10,340	2,090	40	24,980
1988	752 ^{de}	2,290	25,000	10,500	11,650	5,800	950	56,942
1989	600 ^{de}	1,005	7,500	3,700	2,200	2,010	625	17,640
1990	300 ^e	170	7,600	1,150	1,630	410	10	11,270
1991	225 ^e	240	7,400	750	2,550	2,525	130	13,820
1992	460 ^{be}	1,210	8,525	4,000	14,000	15,000	0	43,195
Total	2,671	9,625	242,325	83,515	86,370	46,935	5,330	466,771
Mean	205	963	18,640	6,960	8,637	4,694	533	40,632 ^f

^a Includes Figure Eight, Goblet, Oldham, & Wandering Creeks

^b Tower Counts.

^c Includes tower count plus later aerial survey count.

^d Includes Grassy Creek (tributary downstream of Ugashik Lagoon).

^e Sum of mean indices for all locations.

Appendix Table 20. Aerial survey index counts of pink salmon escapement, Ugashik District, 1980-1992.

Year	Number of Surveys	Pink Salmon Count	Comments
1980	1	2,000	
1982	1	6,000	4,000 in King Salmon River, 2,000 in Painter Creek
1983	2	803	Survey of Dog Salmon River done by done by USFWS
1984	3	656	650 counted in King Salmon River during Sept. 21 float trip
1985	3	0	
1986	1	350	Observed in King Salmon River on Aug. 19
1987	2	1	
1988	7	2,800	Peak count on Aug. 23; 2,000 in King Salmon River
1989	8	50	Observed in Ugashik River on August 9
1990	5	2,000	Peak count on Aug. 13
1991	0	660	Ugashik River tower count.
1992	0	1,728	Ugashik River tower count.

Appendix Table 21. Aerial survey index counts of coho salmon escapement, Ugashik District, 1981-1992.

Year	Number of Surveys	Coho Salmon Count	Comments
1981	1	13,300	Surveyed on Sept. 7
1982	1	10,000	Surveyed Aug. 26
1983	0		
1984	1	6,100	Surveyed on Aug. 31
1985	2	18,880	16,500 in King Salmon River on Sept. 12
1986	2	8,455	Surveyed on Aug. 19 and 25
1987	2	17,000	16,700 in King Salmon River on Aug. 23
1988	7	28,280	12,900 in King Salmon River Sept. 7
1989	4	11,515	7,615 observed on Aug. 14
1990	5	12,610	
1991	0	400	Incidental observation made Aug. 12
1992	0	790	Incidental observation made August 11.

Appendix Table 22. Spawner distribution and total escapement estimates of sockeye salmon, Wood River system, 1959-1992.

Year	Spawner Distribution (%)			Total Escapement ¹
	Creeks	Beaches	Rivers	
1959	32.8	50.3	16.9	2,209,300
1960	27.4	55.5	17.1	1,016,100
1961	11.4	32.3	56.3	460,700
1962	24.0	65.2	10.8	873,900
1963	12.1	68.5	19.4	721,400
1964	18.9	64.0	17.1	1,076,100
1965	40.6	11.1	48.3	675,100
1966	16.4	54.9	28.7	1,208,700
1967	9.3	66.2	24.5	515,800
1968	9.9	50.8	39.3	649,300
1969	8.6	42.4	49.0	604,300
1970	14.0	52.4	33.6	1,162,000
1971	11.2	56.8	32.0	851,200
1972	17.4	45.1	37.5	430,600
1973	11.5	23.9	64.6	330,500
1974	14.1	63.9	22.0	1,708,800
1975	14.5	34.4	51.1	1,270,100
1976	12.7	33.5	53.8	817,000
1977	11.3	39.5	49.2	561,800
1978	14.2	51.3	34.5	2,267,200
1979	7.3	60.4	32.3	1,706,400
1980	20.8	24.5	54.7	2,969,000
1981	23.0	20.7	56.3	1,233,000
1982	14.0	17.2	68.8	976,400
1983	14.3	60.9	24.8	1,361,000
1984	11.4	27.6	61.0	1,002,800
1985	18.6	22.2	59.1	939,000
1986	16.1	23.3	60.6	819,000
1987	27.6	56.1	16.3	1,337,000
1988	31.0	44.4	24.6	866,800
1989	19.6	28.9	51.5	1,186,400
1990				1,069,400
1991			19.0	1,159,900
1992	24.9	56.7	18.4	1,286,300
Mean	17.5	43.9	38.0	1,097,700

¹ Estimated from Wood River tower counts. Rounded to the nearest hundred.

Appendix Table 23. Peak aerial live counts of sockeye salmon, Lake Nunavugaluk drainage, 1973-1992.

Year	Snake River	Snake R.- Eagle Cr. Beach	Eagle Creek	Eagle Lake	Westshore Beach	Killian Creek	Eastshore Beach	East Creek	Southshore Beach	Total
1973	20	50	10	30	210	70	130	0	20	540
1974	60	1,750	130	220	4,220	2,100	2,710	70	160	11,420
1975	80	1,200	90	260	1,250	780	710	0	100	4,470
1976	40	3,000	240		2,820	470	1,270		220	8,060
1977	410	1,520	90	120	2,690	650	1,430		50	6,960
1978	100	1,400	110	180	5,510	1,700	1,630		150	10,780
1979 ^a										
1980 ^a										
1981 ^a										
1982	300	1,220	150	500	1,170	900	1,470	100	10	5,820
1983	0	560			400	110	470	0	10	1,550
1984	500	3,980	800	0	2,570	2,200	3,830	1,600	1,440	16,920
1985	100	4,070	0	700	5,040	3,600	2,240	1,200	490	17,440
1986		2,900	500	690	1,600	400	840	1,400	60	8,390
1987 ^a										
1988 ^a										
1989		2,800	1,000		5,290	1,200	2,060	700	980	14,030
1990	30	2,840	250	300	4,300	2,600	3,280	200	620	14,420
1991	120	2,050	50	340	1,480	240	870	10	300	5,460
1992 ^a										
Mean	147	1,963	246	280	2,589	1,155	1,548	442	307	8,677 ^b
Percent	1.7%	22.6%	2.8%	3.2%	29.8%	13.3%	17.8%	5.1%	3.5%	100.0%

^a No survey conducted.

^b Sum of means for all areas.

Appendix Table 24. Inshore commercial catch and escapement of chinook salmon, in numbers of fish, Nushagak and Togiak Districts, 1973-1992.^a

Year	Nushagak District			Togiak District		
	Catch	Escapement ¹	Total Run	Catch	Escapement ²	Total Run
1973	30,470	35,000	65,470	10,856	11,000	21,856
74	32,053	70,000	102,053	10,798	15,000	25,798
75	21,454	70,000	91,454	7,226	11,000	18,226
76	60,684	100,000	160,684	29,744	14,000	43,744
77	85,074	65,000	150,074	35,218	20,000	55,218
1978	118,548	130,000	248,548	57,000	40,000	97,000
79	157,321	95,000	252,321	30,022	20,000	50,022
80	64,958	141,000	205,958	12,543	12,000	24,543
81	193,461	150,000	343,461	23,911	27,000	50,911
82	195,287	147,000	342,287	33,786	17,000	50,786
1983	137,123	162,000	299,123	38,497	22,000	60,497
84	61,378	81,000	142,378	22,179	26,000	48,179
85	67,783	116,000	183,783	37,106	14,000	51,106
86	65,783	43,434	109,217	19,880	8,000 ^b	27,880
87	45,983	84,309	130,292	17,217	11,000	28,217
1988	16,648	56,905	73,553	15,606	10,000	25,606
89	17,637	78,302	95,939	11,366	10,739	22,105
90	14,812	63,955	78,767	11,130	9,107	20,237
91	22,898 ^c	135,054	157,952	7,088 ^c	12,667	19,755
92	47,897 ^c	82,576 ^c	130,473	12,614 ^c	10,413	23,027
20-Year Ave.	72,863	95,327	168,189	22,189	16,046	38,236
1973-82 Ave.	95,931	100,300	196,231	25,110	18,700	43,810
1983-92 Ave.	49,794	90,354	140,148	19,268	13,393	32,661

¹ Escapements were estimated from the following:

1973-81 - comprehensive aerial surveys.

1982-85 - correlation between index counts and total escapement estimates when aerial surveys were complete.

1986-92 - sonar estimate.

Estimates for 1973-85 are rounded to the nearest thousand fish.

² Escapement estimates based on comprehensive aerial surveys.

Estimates for 1973-88 rounded to the nearest thousand fish.

^a Escapement estimates supersede those previously reported.

^b Minimal estimate based on incomplete data.

^c Preliminary.

Appendix Table 25. Inshore commercial catch and escapement of chum salmon, in numbers of fish, Nushagak and Togiak Districts, 1973-1992.^a

Year	Nushagak District			Togiak District		
	Catch	Escapement ¹	Total Run	Catch	Escapement ²	Total Run
1973	336,331	200,000	536,331	195,431	163,000	358,431
74	157,941	100,000	257,941	80,710	161,000	241,710
75	152,891	80,000	232,891	87,058	114,000	201,058
76	801,064	500,000	1,301,064	153,559	392,000	545,559
77	899,701	609,000	1,508,701	270,649	496,000	766,649
1978	651,743	293,000	944,743	274,967	396,000	670,967
79	440,279	166,000	606,279	219,942	293,000	512,942
80	681,930	969,000	1,650,930	299,682	415,000	714,682
81	795,143	177,000	972,143	229,886	331,000	560,886
82	434,817	256,000	690,817	151,000	86,000	237,000
1983	725,060	164,000	889,060	322,691	165,000	487,691
84	850,114	362,000	1,212,114	336,660	204,000	540,660
85	396,740	288,000	684,740	203,302	212,000	415,302
86	488,375	168,275	656,650	270,057	330,000	600,057
87	416,476	147,433	563,909	419,425	361,000	780,425
1988	371,196	186,418	557,614	470,132	412,000	882,132
89	523,903	377,512	901,415	203,178	143,890	347,068
90	378,223	329,793	708,016	102,861	67,460	170,321
91	465,582 ^b	252,436	718,018	249,113 ^b	149,210	398,323
92	313,034 ^b	302,858 ^b	615,892	174,017 ^b	120,000	294,017
20-Year Ave.	514,027	296,436	810,463	235,716	250,578	486,294
1973-82 Ave.	535,184	335,000	870,184	196,288	284,700	480,988
1983-92 Ave.	492,870	257,873	750,743	275,144	216,456	491,600

¹ Escapements were estimated from the following:

1973-74 - tower enumeration and aerial survey data;

1975-78 - aerial survey data;

1979-92 - adjusted sonar estimate from Portage Creek site.

Estimates for 1973-85 are rounded to the nearest thousand fish.

² Escapement estimates based on aerial surveys; however, surveys were not conducted in 1986 due to budget constraints. Estimate based on catch/escapement proportion using most recent 10-year average data.

Estimates for 1973-88 rounded to the nearest thousand fish.

^a Escapement estimates supersede those previously reported.

^b Preliminary.

Appendix Table 26. Total escapement estimates of pink salmon, Nushagak and Togiak Districts, 1962-1992.^a

Year	Nushagak District ¹	Togiak District ²
1962	543,000	
1964	910,560	
1974	585,520	8,620 ^d
1976	863,430	37,570
1978	9,386,480	150,000 ^d
1980	2,785,200	102,820
1982	1,656,660	44,300
1984	2,926,450	269,950
1986	72,190 ^b	80,000 ^d
1988	494,610 ^b	142,500 ^d
1990	801,730 ^b	207,000
1992	^c	235,000 ^d
Mean	1,911,439	127,776

¹ Includes Wood, Igushik, Snake, Nushagak, & Nuyakuk Rivers, and Ice, Youth, & Sunshine Creeks, unless otherwise noted.

² Includes Togiak, Matogak, Osviak, & Slug Rivers.

^a Only those years of comprehensive aerial coverage are included; even years only; all counts rounded to the nearest 10 fish.

^b Sonar estimate of Nushagak-Mulchatna Rivers only.

^c No escapement estimate.

^d Togiak River estimate only.

Appendix Table 27. Aerial estimates of sockeye salmon escapements, Togiak District, 1973-1992.^a

Year	Togiak River & Tributaries ¹	Kulukak Systems ²
1973	11,200	8,000
74	20,600	4,900
75	19,600	8,600
76	31,200	11,200
77	15,600	40,100
1978	30,600	33,900
79	23,700	26,600
80	50,700	45,700
81	39,700	58,800
82	25,300	52,800
1983	13,200	27,000
84	30,900	49,800
85	8,800	36,600
86	35,000	42,800
87	28,600	37,800
1988	32,400	31,700
89	19,800	10,800
90	47,100	49,600
91	23,700	23,900
92	16,500	26,400
1973-92 Mean (20-Year)	26,210	31,350
1973-82 Mean (10-Year)	26,820	29,060
1983-92 Mean (10-Year)	25,600	33,640

¹ Estimates do not include fish spawning above the counting tower (Togiak Lake outlet); estimates for Togiak River proper are unavailable prior to 1974; estimates for Ungalikthluk, Osviak, Matogak, & Slug Rivers are not included in the 1977-92 data as reported earlier in Data Reports 73 and 81.

² Includes Kulukak River, Kulukak Lake, and Tithe Creek Ponds.

^a All counts are rounded to the nearest hundred.

Appendix Table 28. Peak aerial live counts of sockeye salmon, Togiak River drainage, 1973-1992.

Year	Togiak Mainstem	Gechiak River	Pungokepuk River	Nayorurun River	Kemuk River	Ongivinuck River	Total
1973		1,800	1,900			1,900	5,600
1974	6,000	1,700	1,100			1,500	10,300
1975	6,100	830	1,450			1,380	9,760
1976	11,000	3,300	2,600			2,200	19,100
1977	2,200	500	2,000			3,100	7,800
1978	10,000	2,020	1,200			4,620	17,840
1979	7,100	520	750			2,800	11,170
1980	18,600	3,200	2,500	500	3,200	2,000	30,000
1981	14,100	2,700	3,150			3,400	23,350
1982	2,300	3,600	2,500	0	100	4,800	13,300
1983	4,800	1,100	700	0	0	1,200	7,800
1984	10,550	2,800	2,450	0	0	2,300	18,100
1985	1,800	400	500	0	0	1,700	4,400
1986	13,500						13,500
1987	5,200	3,600	600	0	0	4,900	14,300
1988	9,400	2,000	1,100	0	0	3,700	16,200
1989	7,600	1,500	630			150	9,880
1990	8,770	5,720	5,980	0	2,550	1,190	24,210
1991	7,990	1,640	1,220			1,010	11,860
1992	3,030	1,280	1,400			2,200	7,910
Mean	7,897	2,116	1,775	63	731	2,424	15,006 ^a
Percent	52.6%	14.1%	11.8%	0.4%	4.9%	16.2%	100.0%

^a Sum of means for all streams.

Appendix Table 29. Peak aerial live counts of sockeye salmon, Togiak District, 1973-1992.

Year	Togiak River ¹	Kulukak River ²	Tithe Creek Ponds	Quigmy River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
1973	5,600	1,600	2,400							9,600
1974	10,300	750	1,700							12,750
1975	9,760	780	3,500							14,040
1976	19,100	1,460	4,150							24,710
1977	7,800	6,400	18,200		200	2,000	2,700		1,700	39,000
1978	17,840	8,100	11,800						1,000	38,740
1979	11,170	4,600	10,800		200	200		600	700	28,270
1980	30,000	12,200	14,200		500	200	1,900			63,500 ^a
1981	23,350	15,700	18,250		700	6,400	5,900	3,900	12,800	87,000
1982	13,300	11,900	19,300		0	1,000	5,500	300	2,400	53,700
1983	7,800	8,430	2,720		80	20	2,000	230	940	22,220
1984	18,100	7,400	14,000		200	6,800		100	5,200	51,800
1985	4,400	6,700	11,600		0	200	2,300	260	1,310	26,770
1986	13,500	10,900	14,000							38,400
1987	14,300	10,500	8,400							33,200
1988	16,200	12,600	3,250	250	100	380	5,880	200	2,700	41,560
1989	9,880	2,920	2,500					5,000		20,300
1990	24,140	10,600	14,200	100	400	2,200	3,540	9,700	3,800	68,680
1991	11,860	8,650	3,320	35	860	2,530	560	3,400	2,650	33,865
1992	7,910	7,530	4,950	40	300	3,340	1,460	3,600	3,760	32,890
Mean	15,006	9,071	9,162	106	295	2,106	3,174	2,481	3,247	44,647 ^b
Percent	33.6%	20.3%	20.5%	0.2%	0.7%	4.7%	7.1%	5.6%	7.3%	100.0%

¹ Includes all surveyed sections of Togiak River proper and all tributaries to the Togiak River.

² Includes surveys of Kulukak Lake. Counts prior to 1977 include Kulukak Lake only and are not included in the mean.

^a Includes a combined count for the Negukthlik and Ungalikthluk of 4,500 fish.

^b Sum of means for all streams.

Appendix Table 30. Peak aerial live counts of chinook salmon, Togiak River drainage, 1973-1992.

Year	Togiak River Section ¹						Gechiak River	Pungokepuk River	Nayorurun River	Kemuk River	Ongivinuck River	Total
	A	B	C	D	E	F						
1973	210	370	560	270	530	580	470	110	220	140	220	3,680
1974	610	650	830	300	570	860	620	200	120	160	180	5,100
1975	280	240	240	160	210	760	350	240	140	580	470	3,670
1976	210	250	510	260	450	790	550	350	270	290		3,930
1977							1,190	500	230	120	120	2,160
1978	940	1,240	1,390	810	1,060	1,850	2,150	590	780	220	220	11,250
1979	370	250	330	150	560	890	1,060	360	250	170	220	4,610
1980	180	120	340	230	120	140	910	200	510	170	190	3,110
1981	420	390	500	200	300	740	980	310	370	390	290	4,890
1982					80	320	470	170	190	130	470	1,830
1983	120	220	370	290	360	850	820	240	340	430	350	4,390
1984	250	560	900	560	820	1,920	760	580	270	580	430	7,630
1985	270	320	640	340	470	970	470	250	290	310	460	4,790
1986	150	80	160	30	110	350						880
1987	20	70	170	120	200	480	610	180	100	120	320	2,390
1988	70	70	160	160	170	710	390	180	60	70	90	2,130
1989	10	30	370			940	190	80			40	1,660
1990	230	170	680	365	805	1,085	370	125	75	400	10	4,315
1991	505	165	475	225	520	455	460	105	90	100	150	3,250
1992	150	250	440	225	450	690	250	160	70	175	105	2,965
Mean	278	303	504	276	433	809	688	259	243	253	241	4,286*
Percent	6.5%	7.1%	11.7%	6.4%	10.1%	18.9%	16.0%	6.1%	5.7%	5.9%	5.6%	100.0%

- ¹ Section A; Togiak Bay - Gechiak River
Section B; Gechiak River - Pungokepuk River
Section C; Pungokepuk River - Nayorurun River
Section D; Nayorurun River - Kemuk River
Section E; Kemuk River - Ongivinuck River
Section F; Ongivinuck River - Togiak Lake
* Sum of means for all streams.

Appendix Table 31. Peak aerial live counts of chinook salmon, Togiak District, 1973-1992.

Year	Togiak River ¹	Quigmy River	Kulukak River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
1973	3,680		440				280	30	4,430
1974	5,100		510				150	30	5,790
1975	3,670		1,100				220	80	5,070
1976	3,930		1,080		100		380	30	5,520
1977	2,160		1,480	60	120		440	40	4,300
1978	11,250		2,720	150	250		1,020	110	15,500
1979	4,610	20	2,260	100	210		850	130	8,180
1980	3,110	0	700	70	40		260	160	4,340
1981	4,890	0	1,290	470	1,730	350	1,460	180	10,370
1982	1,830	90	1,690	290	320		1,600	280	6,100
1983	4,390	40	2,460	190	120		1,080	260	8,540
1984	7,630	30	1,190	150	360		680	20	10,060
1985	4,790	0	540	100	50		80	90	5,650
1986	880								880
1987	2,390		300	30	40		660	80	3,500
1988	2,130	10	490	0	40	0	650	170	3,490
1989	1,660		740				560		2,960
1990	4,315	30	635	75	60	0	930	25	6,070
1991	3,250	25	285	75	100		1,175	55	4,965
1992	2,965	15	485	40	105	30	490	35	4,165
Mean	4,286	24	1,073	129	243	95	682	100	6,632*
Percent	64.6%	0.4%	16.2%	1.9%	3.7%	1.4%	10.3%	1.5%	100.0%

¹ Includes all surveyed sections of Togiak River proper and all tributaries to the Togiak River.

* Sum of means for all streams.

Appendix Table 32. Peak aerial live counts of chum salmon, Togiak River drainage, 1973-1992.

Year	Togiak River Section ¹						Gechiak River	Pungokebuk River	Nayorurun River	Kemuk River	Ongivinuck River	Total
	A	B	C	D	E	F						
1973	9,500	2,700	1,000	100	4,900	4,500	3,100	1,400	3,900	100	2,400	33,600
1974	15,900	3,900	3,800	300	4,400	6,900	4,300	2,300	1,700	100	2,600	46,200
1975	5,500	5,200	1,600	500	3,000	19,500	2,600	700	1,100	1,400	1,300	42,400
1976	21,100	12,600	8,400	2,600	13,000	2,700	9,800	2,300	13,000	900	400	86,800
1977	12,000	8,000	10,900	8,000		15,100	13,600	4,900	22,100	3,100	2,400	100,100
1978	24,500	7,400	7,500	1,600	15,200	3,300	6,300	2,500	7,300	1,800	8,100	85,500
1979	14,000	2,800	3,300	800	6,600	10,400	3,500	1,000	2,500	500	200	45,600
1980	41,300	11,000	9,200	900	6,000	3,100	10,200	2,700	10,100	800	3,500	98,800
1981	11,800	4,500	2,400	1,000	3,000	6,000	3,100	500	4,300	1,700	4,200	42,500
1982				200	1,200	2,500	500	400	1,300	100	1,000	7,200
1983	8,160	3,050	3,780	1,100	2,780	6,070	150	140	5,560	570	3,790	35,150
1984	3,900	6,300	800	0	2,600	6,400	3,700	2,000	4,200	700	3,500	34,100
1985	8,300	6,500	3,200	900	6,700	10,200	4,100	600	9,600	1,800	8,300	60,200
1986 ^a												
1987	12,000	9,400	2,700	500	13,200	33,000	2,600	1,200	4,100	700	13,100	92,500
1988	10,000				4,900	3,800	3,700	5,000	3,500	200	3,800	34,900
1989		2,600	2,100		5,000	8,100	290	700			1,200	19,990
1990	2,200	1,275	1,350	400	650	4,200	3,150	1,150	3,400	250	125	18,150
1991	10,200	3,900	2,800	600	5,500	6,000	2,300	500	3,500	800	3,480	39,580
1992 ^b	1,800	1,800	300	100	1,200	1,500	2,000	500	1,800	900	800	22,700 ^c
Mean	13,148	5,695	4,052	1,219	5,802	8,432	4,277	1,666	5,951	913	3,522	54,676 ^d
Percent	24.0%	10.4%	7.4%	2.2%	10.6%	15.4%	7.8%	3.0%	10.9%	1.7%	6.4%	100.0%

¹ Section A; Togiak Bay - Gechiak River
Section A; Togiak Bay - Gechiak River
Section B; Gechiak River - Pungokebuk River
Section C; Pungokebuk River - Nayorurun River
Section D; Nayorurun River - Kemuk River
Section E; Kemuk River - Ongivinuck River
Section F; Ongivinuck River - Togiak Lake

^a No aerial surveys conducted.

^b Counts by section are not representative due to post-peak survey, and are not included in the mean.

^c Preferred total estimate; management survey count conducted 7/15/92.

^d Sum of means for all streams

Appendix Table 33. Peak aerial live counts of chum salmon, Togiak District, 1973-1992.

Year	Togiak River ¹	Quigmy River	Kulukak River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
1973	33,600		7,400	3,400	9,000	2,700	3,500	1,400	61,000
1974	46,200	1,400	7,900	2,100	5,600	1,100	3,000	8,400	75,700
1975	42,400	1,800	6,000	2,600	9,000	3,000	2,300	4,700	71,800
1976	86,800	6,600	14,600	9,600	26,100	7,100	8,000	15,000	173,800
1977	100,100	5,800	21,300	15,300	31,200	2,800	20,000	20,500	217,000
1978	85,500	9,400	24,200	15,000	17,500	6,400	7,600	8,000	173,600
1979	45,600	11,000	16,400	13,400	36,200	4,000	3,800	6,600	137,000
1980	98,800	2,700	27,300	5,700	29,500	6,700	18,500	15,000	204,200
1981	42,500	10,800	11,200	21,700	53,000	3,900	3,800	14,600	161,500
1982	7,200	1,300	8,300	3,100	5,500	2,400	160	1,270	29,230
1983	35,150	4,900	12,960	7,600	11,900	1,210	300	7,360	81,380
1984	34,100	6,300	8,500	10,200	18,400		2,100	3,000	82,600
1985	60,200	1,800	7,800	2,860	5,460	8,800	130	14,650	101,700
1986 ^a									
1987	92,500	1,500	22,000	2,300	2,160				120,460
1988	34,900	10,800	35,000	12,000	17,400	7,600	400	11,300	129,400
1989	19,990	2,820	5,580	7,450	4,900		560		41,300
1990	18,150	555	5,550	1,475	2,300	3,650	750	1,300	33,730
1991	39,580	4,420	9,540	4,730	8,700		120	3,020	70,110
1992	22,700 ^b	600	4,800 ^b	4,400	7,100	1,700	100	4,000	45,400
Mean	54,676	4,694	13,491	7,627	15,838	4,204	4,173	8,241	112,944 ^c
Percent	48.4%	4.2%	11.9%	6.8%	14.0%	3.7%	3.7%	7.3%	100.0%

¹ Includes all surveyed sections of Togiak River proper and all tributaries to the Togiak River.^a No aerial surveys conducted.^b Preferred estimate from a management survey due to post-peak spawning ground survey.^c Sum of means for all streams.

Appendix Table 34. Peak aerial live counts of coho salmon, Togiak River drainage, 1980-1992.

Year	Togiak River Section ¹						Gechiak River	Pungokepuk River	Nayorurun River	Kemuk River	Ongivinuck River	Total
	A	B	C	D	E	F						
1980	3,620	1,010	1,740	1,270	5,080	1,860	3,460	760	1,310	860	740	21,710
1981	9,280	580	100	800	370	750	520	360	230	210	1,300	14,500
1982	2,200	1,500	150	100	1,400	1,700	1,930	1,740	510	200	11,870	23,300
1983 ^a												
1984	1,440	1,190	200	120	620	1,480	4,750	2,240	990	1,110	6,140	20,280
1985	800 ^b	660 ^b	110 ^b	70 ^b	150	820	1,340	750	40	80	6,250	11,070
1986			60	400	100	400					2,560	3,520
1987	340	500	250	200	240	530	1,020	70			1,060	4,210
1988	950	370		140	210	360	1,530				4,100	7,660
1989 ^a												
1990	1,650	390	400	0	540	660	920	450	260	130	1,730	7,130
1991 ^c	4,900	400	700	600	1,680	140					100	8,520
1992	4,420	1,120	1,180	540	2,940	3,080	5,240	1,440	780	1,500	4,460	26,700
Mean	2,744	813	466	364	1,165	1,164	2,301	976	589	584	4,021	14,785 ^d
Percent	18.6%	5.5%	3.1%	2.5%	7.9%	7.9%	15.6%	6.6%	4.0%	4.0%	27.2%	100.0%

¹ Section A; Togiak Bay - Gechiak River
Section B; Gechiak River - Pungokepuk River
Section C; Pungokepuk River - Nayorurun River
Section D; Nayorurun River - Kemuk River
Section E; Kemuk River - Ongivinuck River
Section F; Ongivinuck River - Togiak Lake

^a No aerial surveys conducted.

^b Proportional estimates based on 1984 data.

^c Timing of aerial surveys did not coincide with the period of peak spawning activity, and therefore, 1991 counts were not included in the mean or percent.

^d Sum of means for all streams.

Appendix Table 35. Peak aerial live counts of coho salmon, Togiak District, 1980-1992.

Year	Togiak River ¹	Quigmy River	Kulukak River	Matogak River	Osviak River	Slug River	Negukthlik River	Ungalikthluk River	Total
1980	21,710		10,300						32,010
1981	14,500		3,790				100	840	19,230
1982	23,300		3,380						26,680
1983 ^a									
1984	20,280		10,750	1,850	1,080	670			34,630
1985	11,070	200	7,790	610	420				20,090
1986	3,520								3,520
1987	4,210	30	910	440	120			130	5,840
1988	7,660	460	1,840	310	490	470	370	3,170	14,700
1989 ^a									
1990	7,130	1,030	5,200	2,680	1,490	810		4,150	22,490
1991 ^b	8,520		4,200						12,720
1992	26,700		12,640						39,340
Mean	14,785	430	6,288	1,177	720	650	235	2,073	27,439 ^c
Percent	53.9%	1.6%	22.9%	4.3%	2.6%	2.4%	0.9%	7.6%	100.0%

¹ Includes all surveyed sections of Togiak River proper and all tributaries to the Togiak River. See Appendix Table 34.

^a No aerial surveys conducted.

^b Timing of aerial surveys did not coincide with the period of peak spawning activity, and therefore, 1991 counts were not included in the mean or percent.

^c Sum of means for all streams.

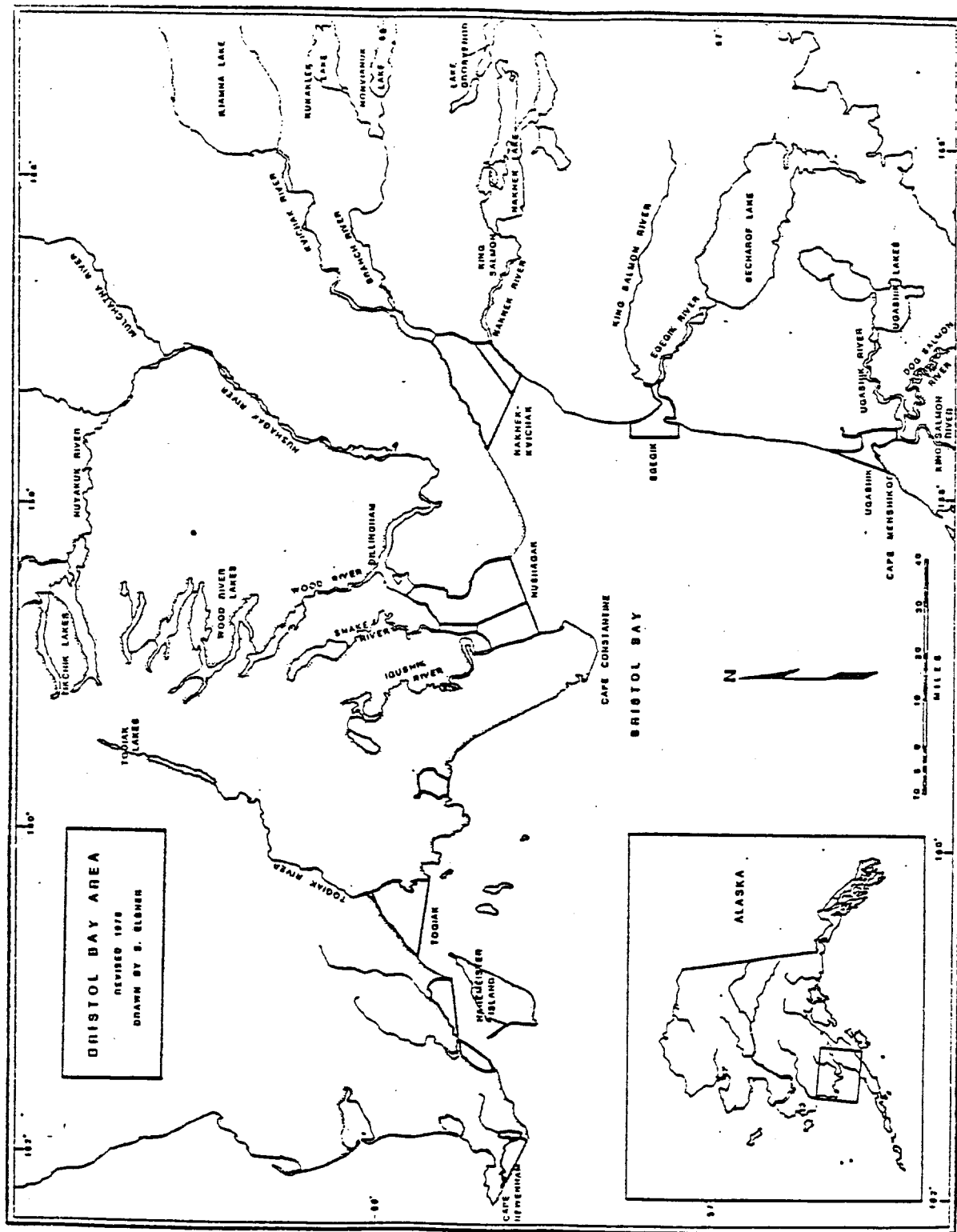


Figure 1. Bristol Bay management area, Alaska.

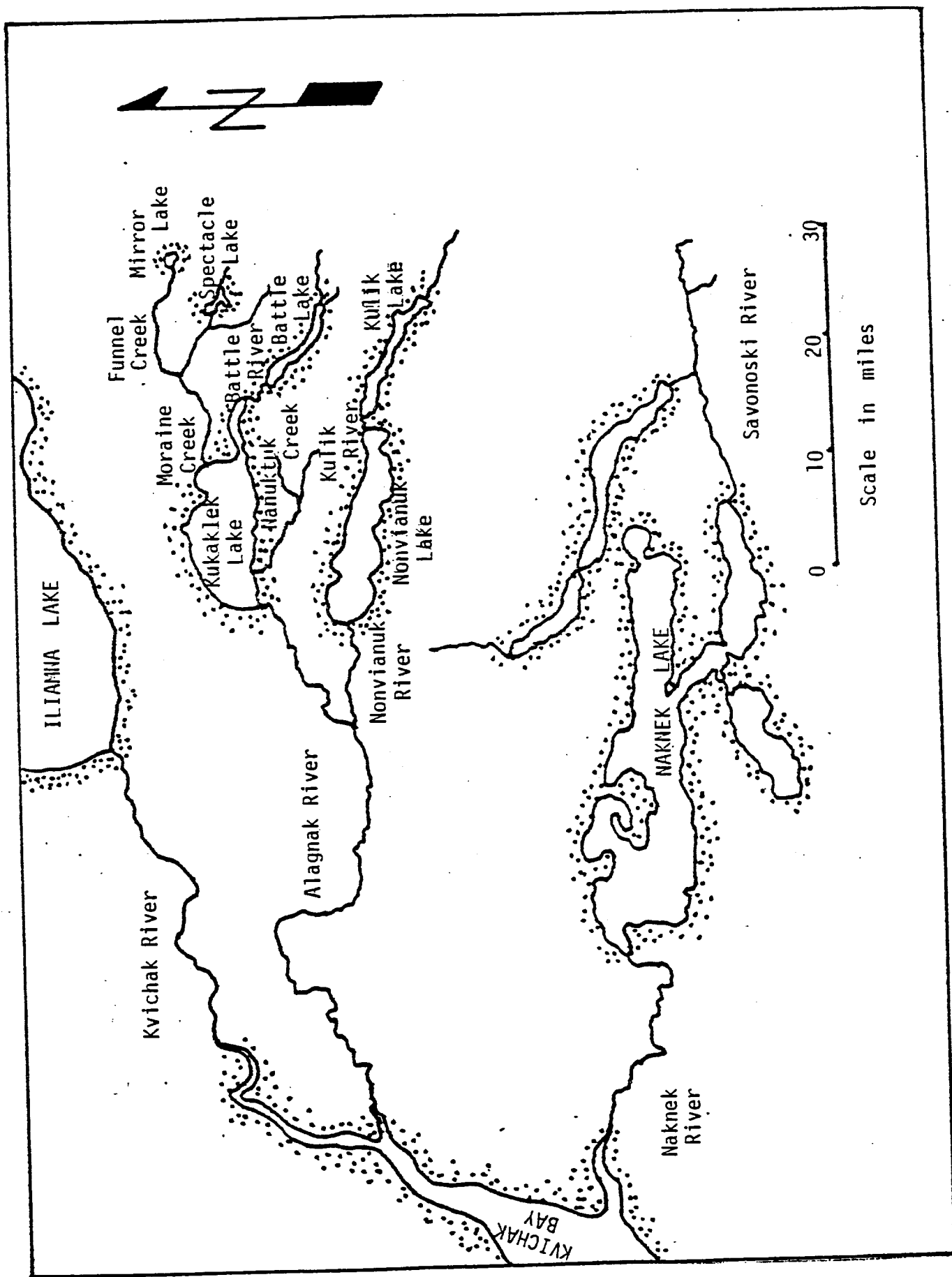


Figure 2. Alagnak River drainage, Bristol Bay, Alaska.

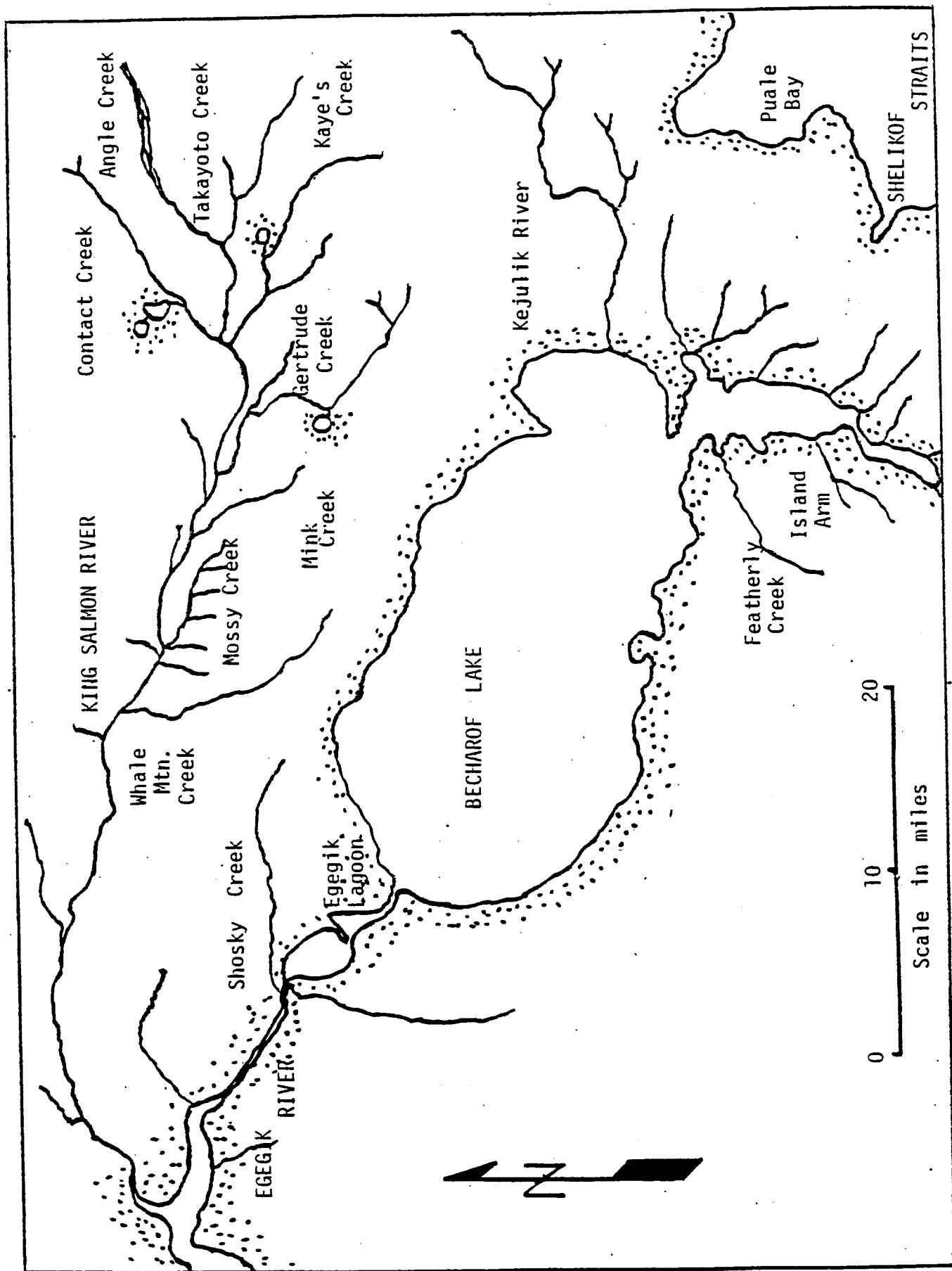


Figure 3. Egegik River drainage, Bristol Bay, Alaska.

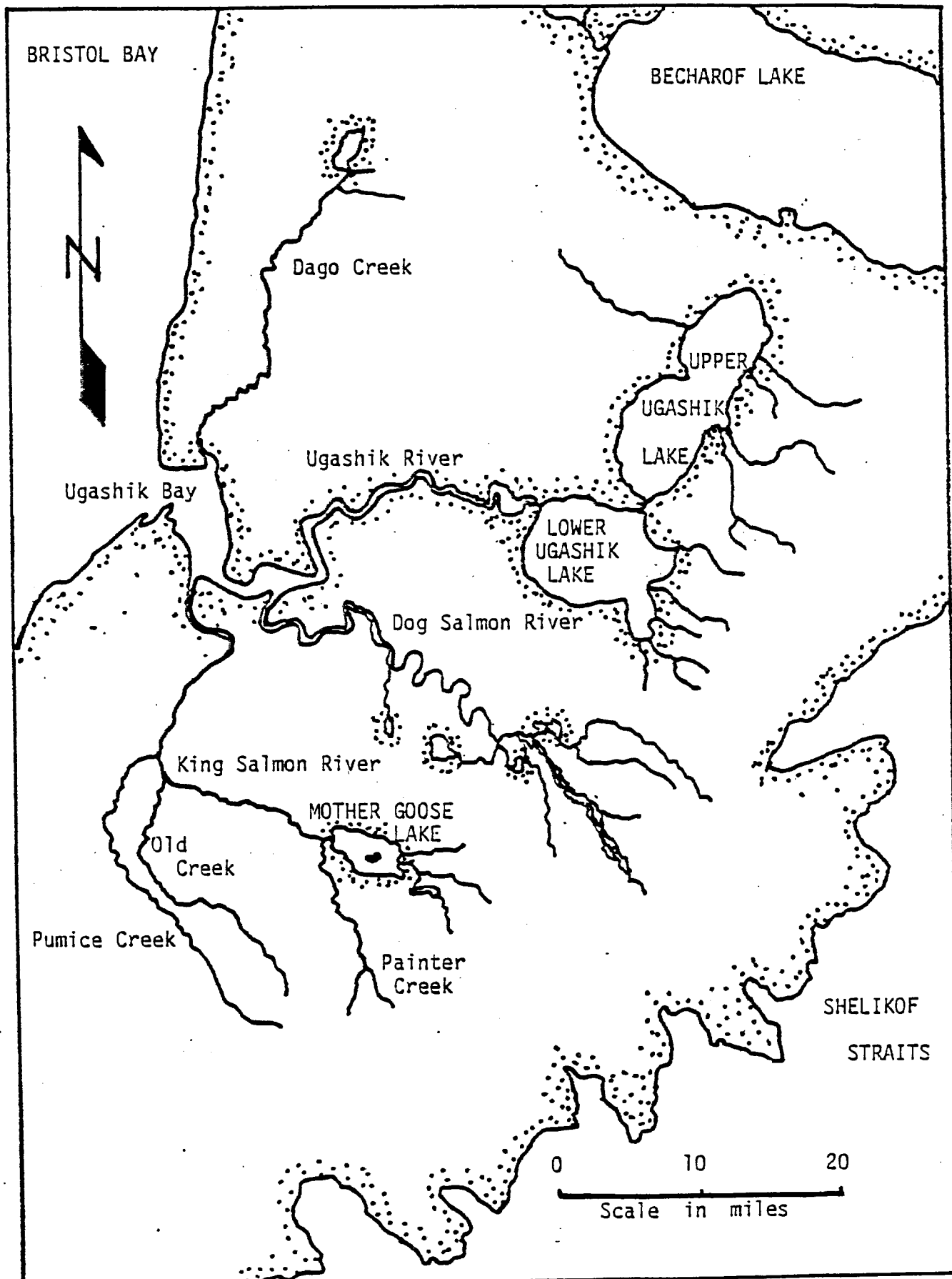
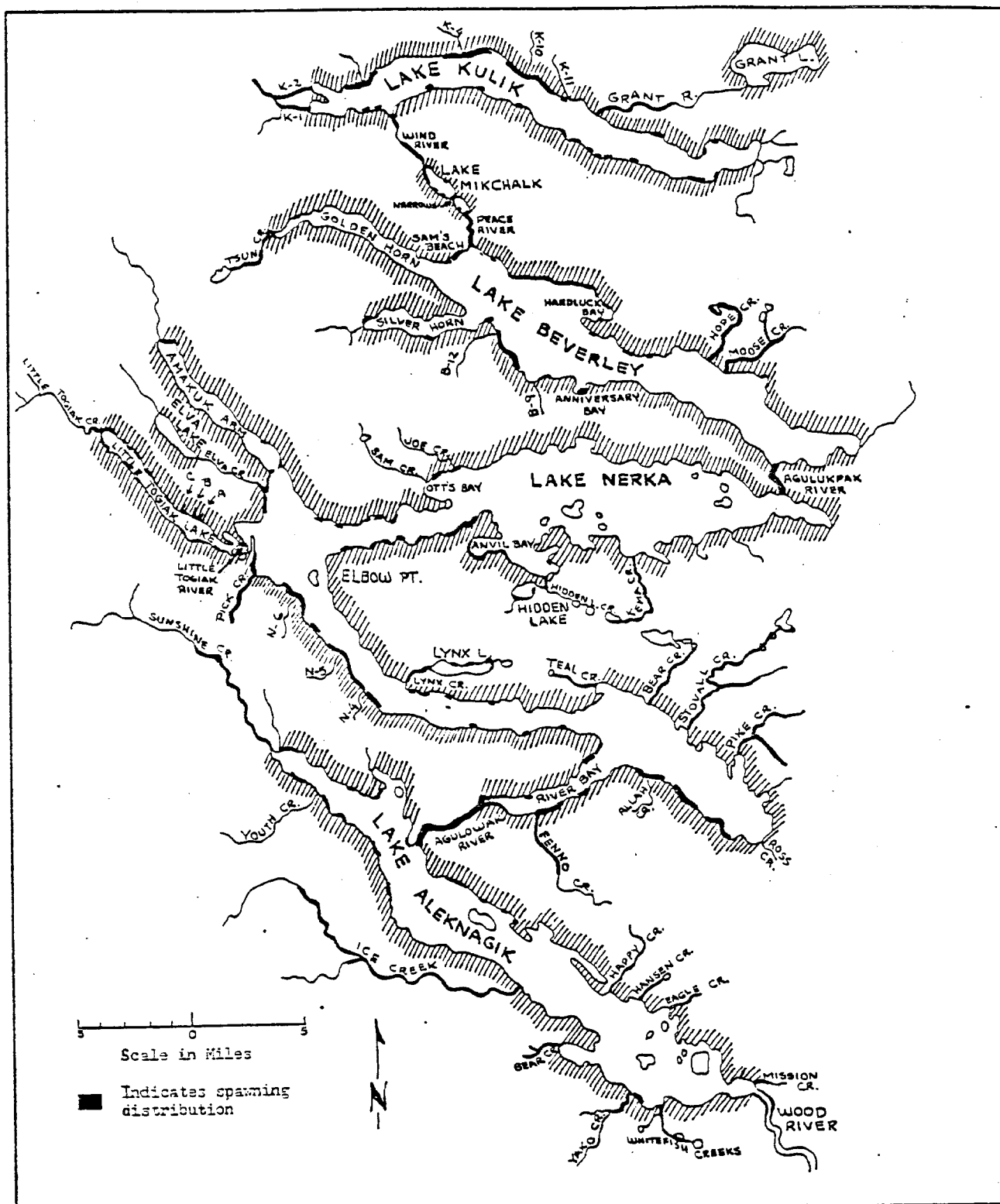


Figure 4. Ugashik River System, Bristol Bay, Alaska.



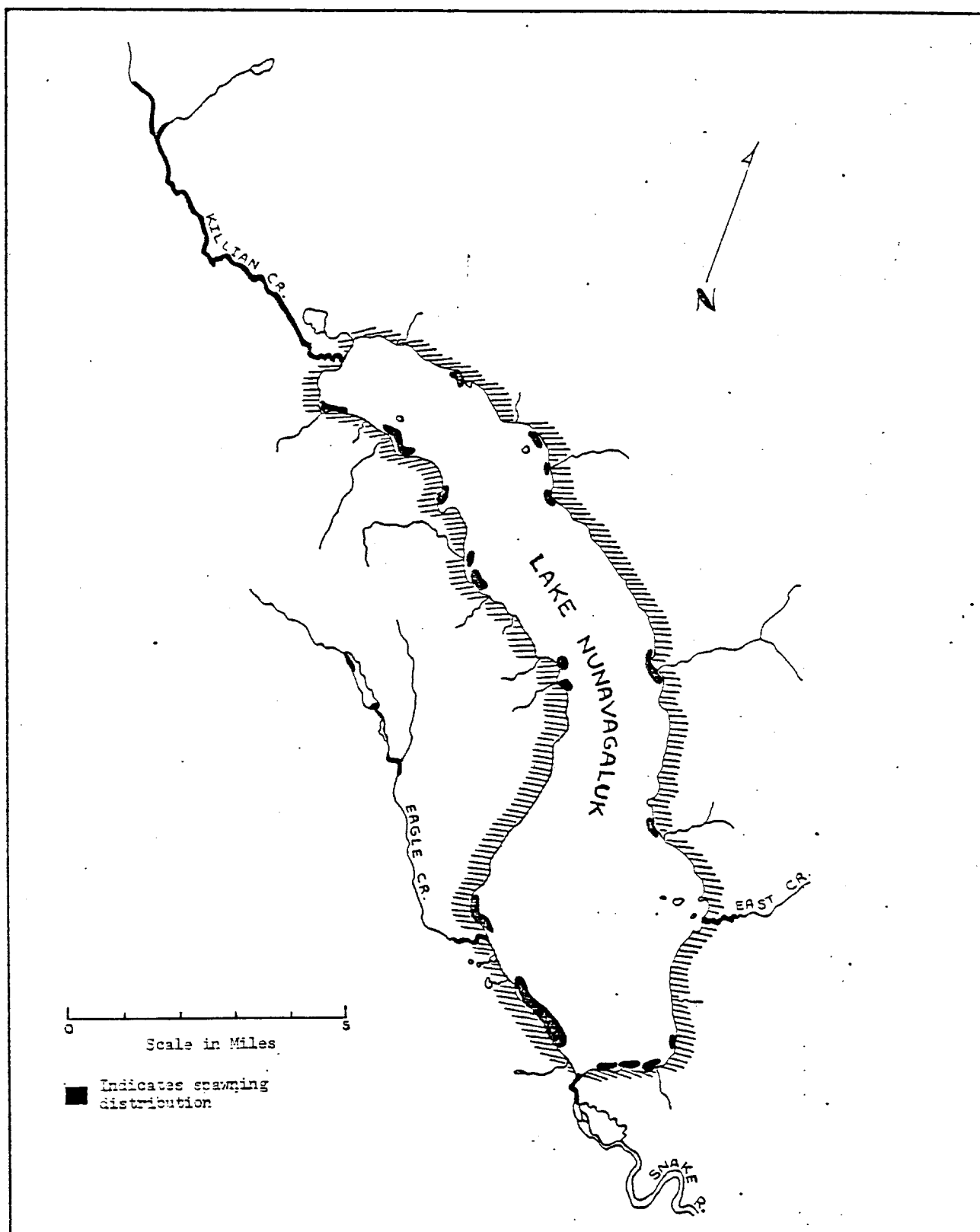


Figure 6. Lake Nunavagaluk system, Bristol Bay, Alaska.

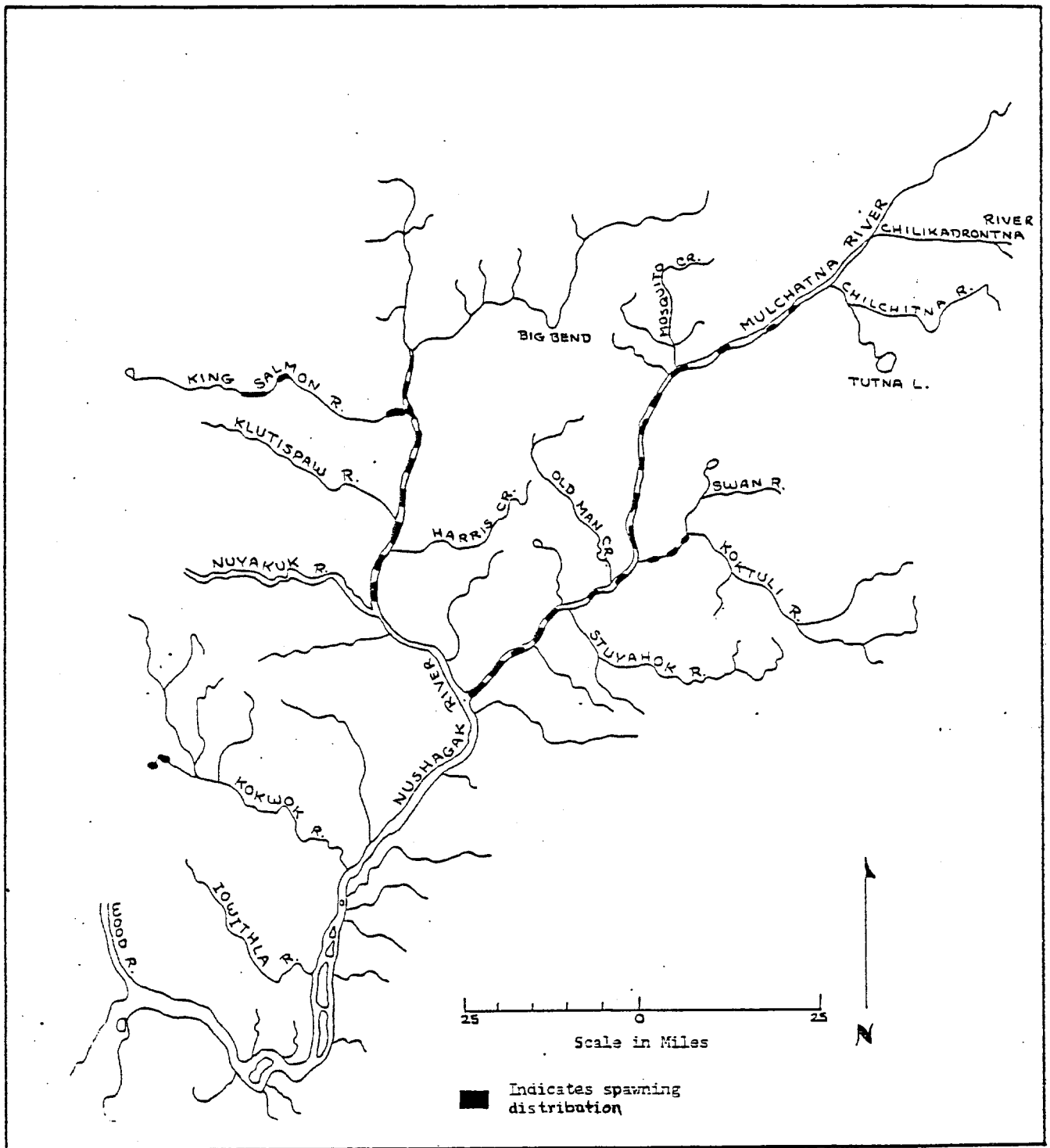


Figure 7. Nushagak-Mulchatna River system, Bristol Bay, Alaska.

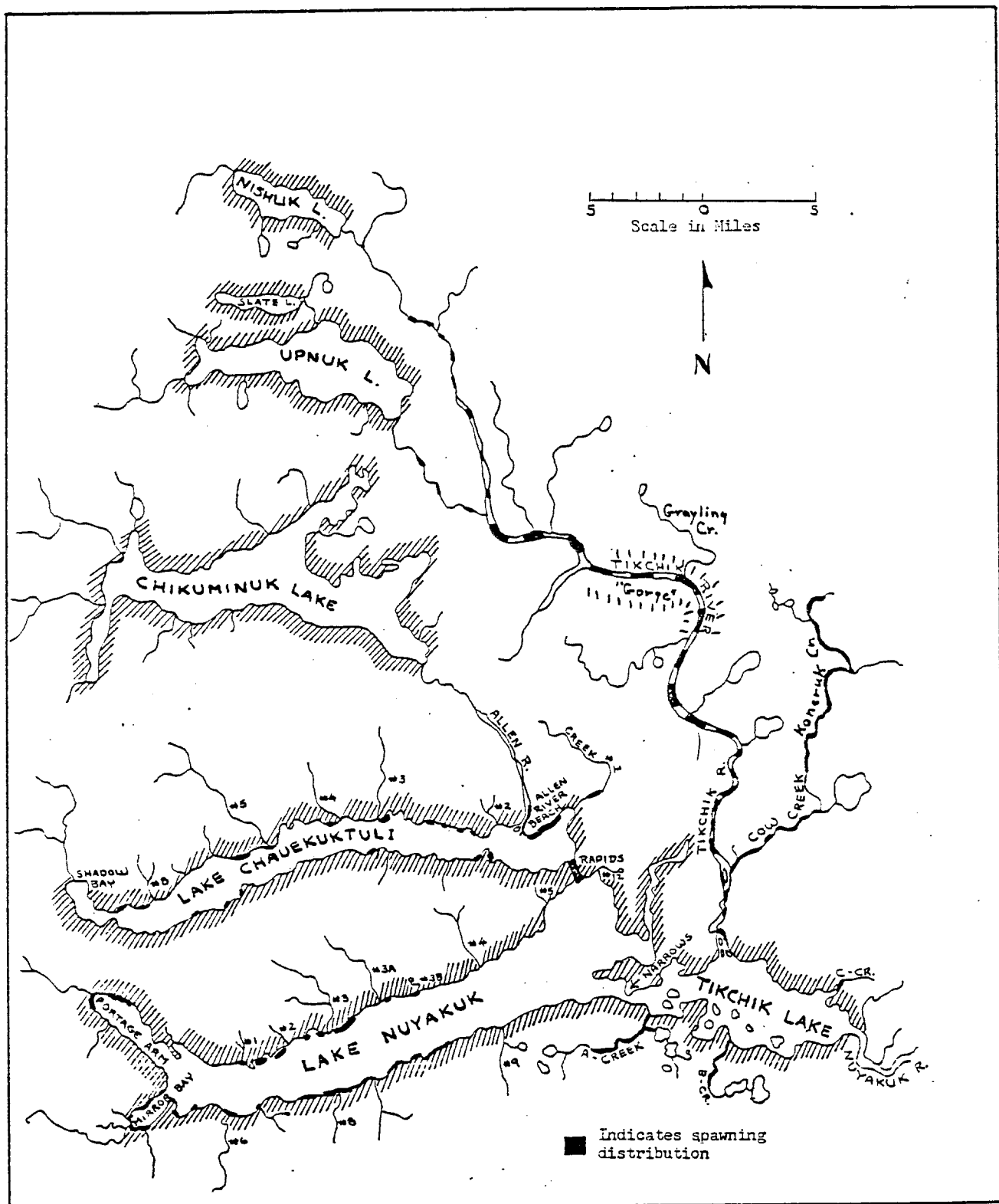


Figure 8. Tikchik Lakes system, Bristol Bay, Alaska.

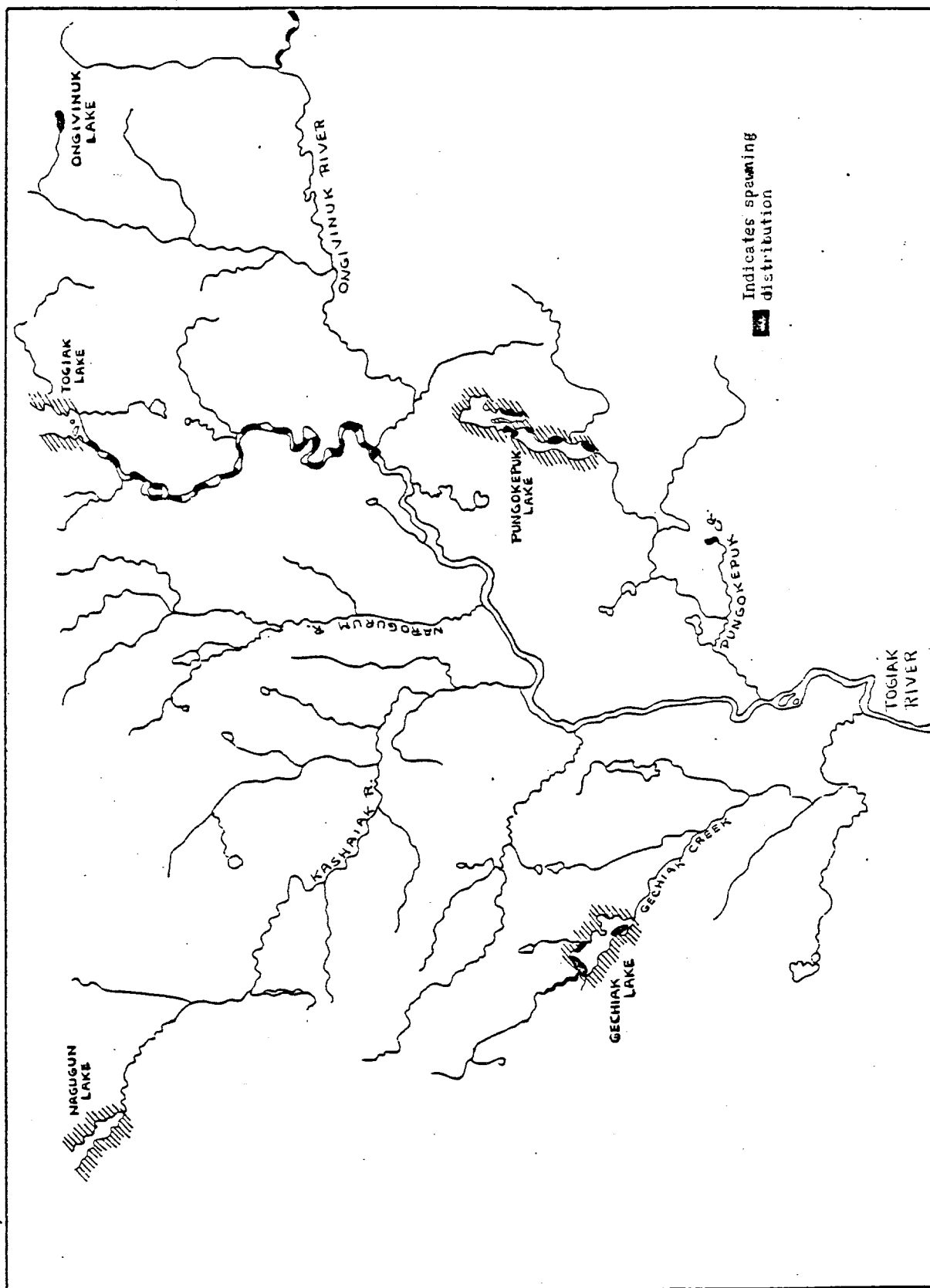


Figure 9. Togiak River system, Bristol Bay, Alaska.

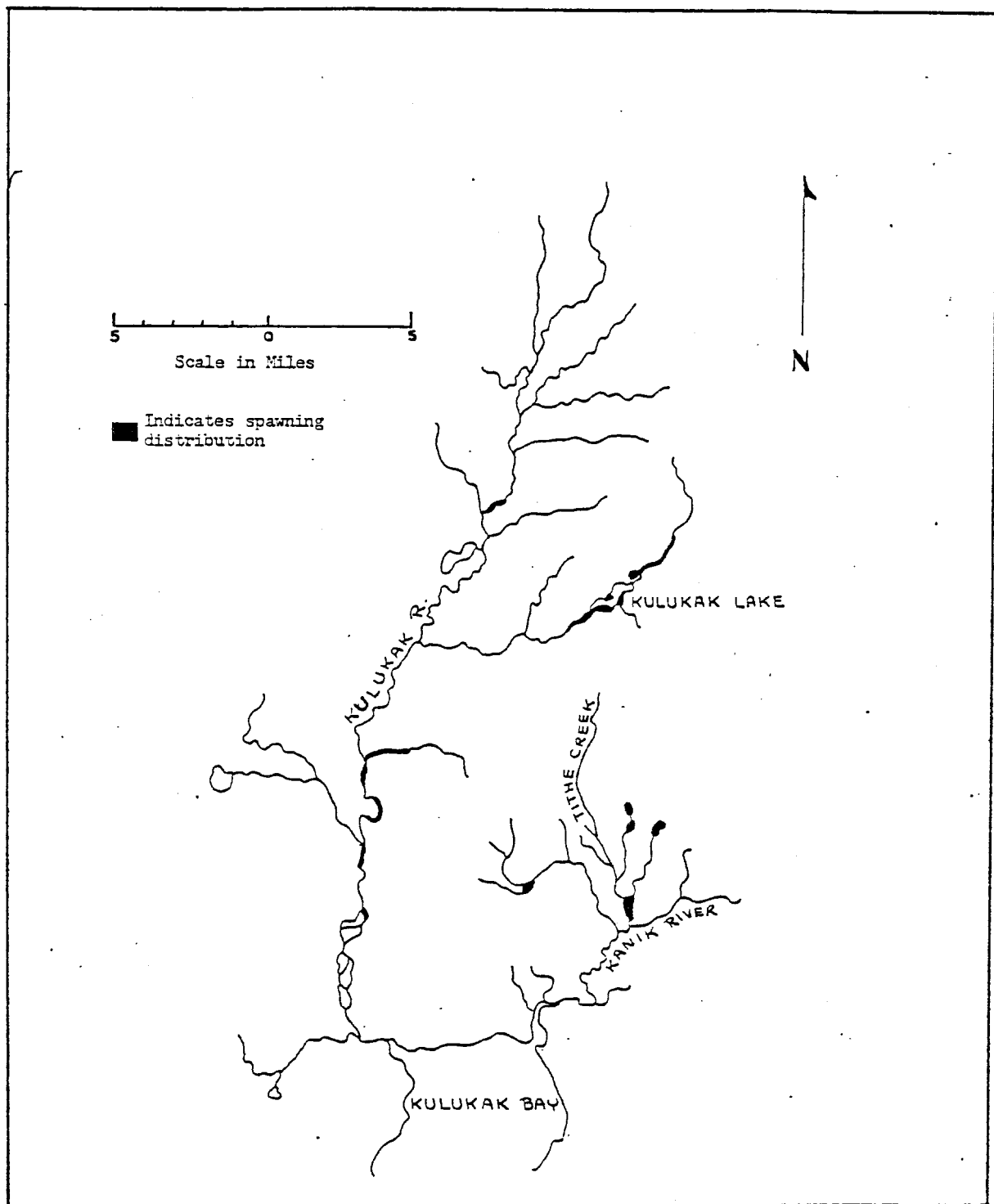


Figure 10. Kulukak River system, Bristol Bay, Alaska.